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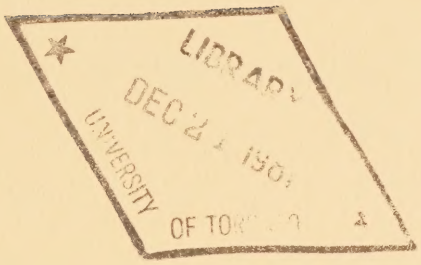

Data Products from the First GARP Global Experiment

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Ottawa, Ontario

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ABSTRACT

The First GARP Global Experiment (FGGE) took place in 1979. Part of the experiment was the deployment throughout the year of about 300 drifting buoys in the ocean of the southern hemisphere. The buoys relayed position and sea surface temperature, among other parameters, by satellite to a receiving station in France. These data were then forwarded to the Marine Environmental Data Service in Canda for analysis. Maps of the sea surface temperature (SST) and SST anomalies averaged over 5 days and buoy positions over 5-day intervals were produced for the entire year. This report contains all of this information, a description of the technique used to produce the maps and other analyses.

RÉSUMÉ

La première expérience mondiale du GARP a eu lieu en 1979. Une partie de l'expérience constituait en l'installation, au cours de l'année, d'environ 300 bouées dérivantes dans l'océan de l'hémisphère sud. Les bouées transmettaient la position et la température de surface de la mer, entre autres paramètres, par satellites à une station réceptrice en France. Ces données étaient ensuite transmises au Service des données sur le milieu marin du Canada, pour analyse. On a donc pu produire, pour toute l'année, des cartes des moyennes sur 5 jours, de la température de surface de la mer ainsi que les anomalies de température et la position des bouées à intervalles de 5 jours. Le présent rapport contient cette information ainsi qu'une description de l'analyse utilisée pour produire les cartes et d'autres analyses.

INTRODUCTION

The Global Atmospheric Research Programme (GARP), 1965-1980, was an international project jointly sponsored by the World Meteorological Organization and the International Council of Scientific Unions. The First GARP Global Experiment (FGGE), or Global Weather Experiment (Anon. 1978), was conceived to supply the necessary boundary conditions for general atmospheric circulation models for the world. In order to fulfill this objective, global surface temperatures were to be monitored daily. Since the southern hemisphere is predominantly covered by water, the technique was to use drifting buoys to monitor sea surface temperature (SST) and sea level pressure, and to relay the information by satellite to operational centres. Approximately 300 buoys were deployed in the ocean south of 20°S by ships of opportunity, research vessels and aircraft (with an average spacing of 1,000 km). The Marine Environmental Data Service (MEDS) of Canada volunteered to receive the data from the buoys via the Global Telecommunication System and to prepare in near-realtime maps of SST and buoy tracks every 5 days during the operational year of FGGE. This task was begun in January 1979.

This report has been produced to document the techniques used in the analyses and to present all of the products under a single cover. In the course of the work, MEDS produced other analyses which are also included. The mathematical background of the analyses used to produce these products is described in detail. This has been done so that readers may judge the suitability of these products to their application.

AN OVERVIEW

The MEDS contribution to FGGE was the production of a set of three near-realtime products during the operational year. The products were buoy tracks, an SST map and an SST anomaly map. These maps, on polar stereographic projection, were produced for 75, 5-day periods and were distributed to a mailing list as soon as possible after the end of each 5-day period.

The technique used to generate the anomaly maps and the SST charts was "optimum interpolation," as described by Gandin (1965) and Bretherton et al. (1976). This technique requires essentially a set of average conditions, which can be chosen in various ways. For the analyses of the drifting buoy data, the average conditions were chosen as the climatological mean. The dataset used was obtained from the U.S. National Climatic Center, Ashville, North Carolina, and included all available sea surface temperatures by 5° square and by month.

There are about 3 million temperature readings for each of the 12 months. The information in each 5° square consists of average temperature, sample size, the standard deviation in the mean of the temperature, and the average position. To generate the climatic maps, these data were interpolated in space, as necessary, using the optimum interpolation technique, and in time using simple linear interpolation.

Generally, the climatic temperature grid was blanked in regions where the expected error was greater than 1C°. For the most part, the blanking eliminated extrapolations close to Antarctica for the months of November through March. However, from April onward, occasional "holes" in the data coverage began to appear, mainly south of latitude 55°S. In these holes, the interpolated values were allowed to remain, even though the expected error exceeded 1C°, provided the interpolation appeared to be essentially linear and the values maintained rough agreement with the 1977 U.S.S.R. Oceanographic Atlas (Anon. 1977).

The optimum interpolation technique also required as input a spatial correlation function and an estimate of noise. The spatial correlation function and noise estimate used for the SST anomaly maps were derived by fitting a Gaussian curve to the first eight 5-day sets of data. The noise value is related to some combination of the accuracy or sensitivity of the instrument and to the fact that the field is not perfectly sampled and spatial aliasing exists. The noise value arrived at was 0.57°C and the correlation scale for the buoy data was 900 km. The noise and correlation scale were updated about once a month as more data became available. The noise value arrived at for the climatic SST was 1.61°C with a correlation scale of 3800 km.

The validity of the estimated correlation function and noise can be partially checked by comparing the rms actual and expected residuals (difference between observation and fit) at the data points. For the eight 5-day periods between 28 December 1978, and 5 February 1979, an average ratio of actual to expected residuals of 1.07 was obtained, with 95% confidence limits of .99 and 1.15. Ideally, this ratio should be 1.0.

One purpose of producing the temperature anomaly map was to effect some quality control on the drifting buoy data: buoys which differed dramatically from climatology could be found with ease on these maps. It soon became obvious that these maps were rather more interesting than the SST maps themselves since changes were more easily seen on these than on the SST maps. It was decided therefore to include the anomaly map as a product. Comments were also prepared on the features found in the anomaly maps and sent out with them. When reading these comments, one must realize that the words "warmer" and "colder" are in reference to the climatological dataset described above.

THEORY OF OPTIMUM INTERPOLATION

Optimum interpolation is a technique whereby interpolations and error estimates can be made from randomly-distributed observations. It is based on the Gauss-Markov theorem and has been used by Russian meteorologists in their analyses of pressure and wind fields (Gandin 1965). Its first application outside of the Soviet Union to oceanographic problems was in the MODE experiment in 1973. One of its uses was the analysis of the extensive data produced by this experiment (Freeland and Gould 1976). Descriptions of the results employing this technique can be found in a variety of publications (e.g. Bretherton et al. 1976; Alaka and Elvander 1972). In this first section, the development of Bretherton et al. is followed closely.

Consider a scalar field, such as temperature, θ_x, where x indicates the position. Assume the mean value of θ is zero. Thus:

$$\overline{\theta}_x = 0 \qquad \overline{\theta_x \theta_{x+r}} = F(r)$$

where F is the covariance function and the averaging is over all realizations. F is assumed to depend only on the separation, r, between any two points. Let ϕ_x be the observed value of θ at x and let there be n observations over the field.

In general, ϕ is composed of two parts: the signal, θ, and the noise, e,

$$\phi_i = \theta_i + e_i \quad (i = 1, \ldots, n) \tag{1}$$

We assume that e's are uncorrelated among themselves and with the θ's, and have zero mean ($\overline{e_i} = 0$) and variance E.

$$\overline{e_i \theta_j} = 0 \qquad \overline{e_i e_j} = E\delta_{ij} \quad (i, j = 1, 2, \ldots, n)$$

The Gauss-Markov theorem states that the least squares optimum linear estimator, $\hat{\theta}_x$, of θ_x is given by:

$$\hat{\theta}_x = \sum_i C_{xi} \sum_j a^{-1}_{ij} \phi_j \tag{2}$$

where

$$a_{ij} = \overline{\phi_i \phi_j} = F(x_i - x_j) + E\delta_{ij}$$

and

$$C_{xi} = \overline{\theta_x \phi_i} = F(x - x_i)$$

where a^{-1} denotes an element of the matrix A^{-1}, the inverse of A. The error is then:

$$\overline{(\theta_x - \hat{\theta}_x)^2} = C_{xx} - \sum_{ij} C_{xi} C_{xj} a^{-1}_{ij}$$

For some fields, as in the case for the climatic sea surface temperature, SST, the covariance function is not well determined. In this case, the structure function, G, can be used. Thus:

$$G(r) = \overline{(\theta_{x+r} - \theta_x)^2} = 2\left[F(0) - F(r)\right] \tag{3}$$

Then the estimated structure function is:

$$\hat{G}(r) = \overline{(\phi_{x+r} - \phi_x)^2} = G(r) + 2E \qquad (4)$$

The result of using the structure function is to modify the expressions for $\hat{\theta}_x$ and the error to:

$$\hat{\theta}_x = \tilde{\theta} + \sum_i C_{xi} \left[\sum_j a_{ij}^{-1} (\phi_j - \tilde{\theta}) \right] \qquad (5)$$

where

$$C_{xi} = -\frac{1}{2} G(r_{xi})$$

$$\tilde{\theta} = \sum_{ij} a_{ij}^{-1} \phi_j \Big/ \sum_{ij} a_{ij}^{-1}$$

and

$$\overline{(\theta_x - \hat{\theta}_x)^2} = C_{xx} - \sum_{ij} C_{xi} a_{ij}^{-1} C_{jx} + \left(1 - \sum_{ij} C_{xj} a_{ji}^{-1} \right)^2 \Big/ \sum_{ij} a_{ij}^{-1} \qquad (6)$$

It is possible then, that from an estimate of the noise in a set of observations and the observations themselves, we can construct an optimally interpolated and convenient dataset on which contours may be drawn.

APPLICATION TO CLIMATIC SST MAPS

MEDS produced two products with this technique: a map of the climatic SST and a map of the SST anomaly. Maps of SST for any 5-day period were obtained by adding the anomaly to the appropriate climatic SST. Optimum interpolation was used in both cases but applied in slightly different ways; details of the application are in Taylor (1980).

It was decided early in the program that SST anomaly charts should be produced for each 5-day period, since it was difficult to see changes in the SST charts from one 5-day period to the next. In order to construct the anomaly maps it was necessary to know the mean conditions. These data (supplied by the National Climatic Center in Ashville, North Carolina, U.S.A.) were compiled from many sources (ships of opportunity but not satellite) and consisted of SST values aggregated in squares 5° on a side covering the entire world ocean for each of the 12 months of the year. The data go back as far as 1860, but about 60% were taken after 1945. For each month, there were about 1,600 five-degree squares containing data, with a total of about 3×10^6 observations. Each month was analyzed separately, as described below, to produce a contour map of climatic SST for as much of the world as the

data covered.

For each 5° square, the average temperature, $\bar{\phi}_i$, the number of observations, n_i, the standard deviation of the temperature, σ_i, and the average position, x_i, were given. Each 5° square will be called a clump.

Then the total number of observations in any month is:

$$n_t = \Sigma\, n_i \quad (i = 1, 2, \ldots, L)$$

where there are L clumps. The average temperature and variance are:

$$\bar{\phi}_t = \frac{1}{n_t} \sum_i n_i \bar{\phi}_i$$

$$\sigma_t^2 = \frac{1}{n_t - 1} \left\{ \sum_i \left[n_i \bar{\phi}_i^2 + (n_i - 1)\sigma_i^2 \right] - n_t \bar{\phi}_t^2 \right\} \quad (i = 1, \ldots, L)$$

As stated before, each observed temperature is assured to be composed of two parts.

$$\bar{\phi}_i = \theta_i + e_i$$

where θ_i is the true climatic temperature at the central point of the month and the average observation position in the i^{th} 5° square. The noise is e_i and is due to the variations in time of the month of the observations, year-to-year fluctuations, observational errors, and variations in position of the observations within the 5° square. For simplicity, all observations in a 5° square are assumed to be at the average position.

The variance of e_i is:

$$E_i = E/n_i \tag{7}$$

where E is the noise variance in a single observation and is assumed constant over the entire globe. As before, assume the e's are not correlated with themselves or the θ's.

Because it was not reasonable to assign a mean climatic temperature applicable to the whole world, it was decided to use the version of optimum interpolation which does not require an estimate of the mean. In this case, the covariance function is obtained through the structure function rather than through the covariances.

The estimated structure function is:

$$\hat{G}(r) = \overline{(\phi_{x+r} - \phi_x)^2} = G(r) + 2E$$

where ϕ_x is the observed temperature at positon x, and r is the great circle distance from x. The averaging is done over all pairs of individual observations.

It was not necessary to accommodate all possible pairs of observations to estimate G(r). Eleven thousand pairs (from 150 observations) were chosen randomly from the 1,600 data clumps over the world. Also, it was not necessary to look at pairs separated by more than 4,000 km, since an interpolating grid point would always be closer than this to the surrounding observations. The range, 0 to 4,000 km, was divided into twenty 200-km segments. For each segment, the estimated structure function was calculated. Because only the statistics of the climatic data were known, equation 4 was rewritten as:

$$\hat{G}(r) = \frac{1}{\Sigma W_{ij}} \Sigma W_{ij} \left\{ \frac{n_i - 1}{n_i} \sigma_i^2 + \frac{n_j - 1}{n_j} \sigma_j^2 + (\overline{\phi}_i - \overline{\phi}_j)^2 \right\}$$

The summation is over all i,j $i \neq j$, whose separation falls into the particular 200-km segment and r is the average separation of the pairs.

W_{ij} is a factor designed to weight data clumps according to the number of observations in a clump. It is:

$$W_{ij} = \left[\frac{4 n_i n_j}{n_i + n_j + 2} \right] \exp\left(\hat{E}/\sigma_t^2\right)$$

where $\hat{E}$ is the preliminary estimate of the noise variance in the data. The formula for W_{ij} is empirical but reduces to $W_{ij} = 1$ when $n_i = n_j = 1$ or when $\hat{E} = 0$. When the data are entirely noise (i.e. when $\hat{E} = \sigma_t^2$), W_{ij} approaches a reasonable value.

From equation 3, the estimated covariance function is:

$$\hat{F}(r) = -\frac{1}{2} \hat{G}(r)$$

to within a constant. What has been called $\hat{F}(r)$ is actually an estimate of $F(r) - F(0) - E$. That is, the constant $F(0) + E$ has been removed. This should cause no trouble for, as Bretherton et al. notes, results are unaffected by the subtraction of any constant. When this function was plotted, it was found that a power type curve would best approximate it. It was fitted by the function:

$$F_f(r) = - E - \sigma_t^2 (r/r_s)^{1.6}$$

where the noise variance, E, and the distance, r_s, are to be found. The exponent, 1.6, was chosen empirically to give a good fit to F_f in all 12 months.

E was found by plotting $\hat{F}(r)$ against r^2 for the smaller values of r and estimating the value at r = 0 by linear extrapolation, the zero-crossing being at - E. A value for r_s was found by plotting $\hat{F}(r)$ against r and determining where the curve fell to the value of $- E - \sigma_t^2$. (Notice that except in the weighting factor, σ_t^2 is not essential here but is just a convenient normalizing factor).

The assumption here is that for each month, r_s is independent of direction. This is obviously not true for world SST data, but it is a simplifying assumption which still leads to satisfactory results, and no attempt was made to separate the north-south and east-west components of covariance. The estimates of E and r_s obtained for the 12 months were consistent. Values of $\sqrt{E}$ fell between 1.45C° and 1.74C° and for r_s between 3,500 km and 3,900 km.

Knowing the noise and covariance function, optimum interpolation can now be applied to interpolate the data onto a uniform grid. For reasons of economy, only the 16 nearest data clumps were used in gridding the climatic temperature at each point of a 2 1/2° by 2 1/2° world grid. The grid was chosen twice as fine as the original data simply to ensure correct contour lines passed through the observations.

For each point of the grid, the covariance matrix, A, was calculated (as in equation 2):

$$a_{ij} = F_f(r_{ij}) + E_i \delta_{ij}$$

where E_i is given by equation 7 and i,j now cover only the 16 closest data clumps to the grid point at x. The great circle distance between clumps i and j is r_{ij}.

In general, matrix A will be ill-conditioned, but any constant may be added to F_f without disturbing the results. Therefore, to improve the matrix conditioning, a constant:

$$K = \frac{\Sigma\ (\bar{a}_{kk} - a_{ij})^2}{\Sigma\ (\bar{a}_{kk} - a_{ij})} - \bar{a}_{kk}$$

was added to F_f. The sums are over all off-diagonal elements, and $\bar{a}_{kk}$ is the average diagonal element. The covariance function is now defined as:

$$F(r) = F_f(r) + K$$

and the elements a_{jj} are now $a_{jj} + K$. The estimated climatic temperature at the grid point is then calculated using equation 5 and the expected error by equation 6. When this procedure has been performed for each point of the grid, we have arrays of the estimated climatic temperature and the expected error on a 2 1/2° by 2 1/2° grid. The two arrays are 145 by 73 and cover the entire world.

For each month, a preliminary plot of the world SST in a square projection was produced (Figures 1-12 *on microfiche*). The values of $\overline{\phi}_i$, n_i and σ_i were plotted at the average position of each data clump. Contours of the estimated climatic temperature were plotted at 1C° intervals and of the expected error at 0.5C° intervals.

It was found that some editing of the climatic data was necessary. The procedures were as follows:

1) On occasion, it was found that in sparse data regions, the value of $\overline{\phi}$ for a small clump was inconsistent with surrounding data. The result was a deflection of the contour lines in the region. Such data were considered suspect, and the value of $\overline{\phi}$ was reassigned to preserve the character of the SST field as defined by the neighbouring points.

2) Where the expected error exceeded 1C°, such as occurred mainly south of the southernmost data, the temperature contours were blanked out.

3) Any gaps in the SST values down to 60° south were filled using linear interpolation and an atlas (Anon. 1977) as a guide.

4) No serious effort was made to edit the results in the northern hemisphere, since the analysis was confined to the southern hemisphere.

The changes and the additions were then fed into a computer program which edited the 2 1/2° by 2 1/2° grid of climatic data. A final map of the data and SST contours was then produced in polar stereographic projection (Figures 13-24 *on microfiche*). The expected error map was omitted from the final map to reduce the clutter.

APPLICATION TO SST ANOMALY MAPS

The climatic temperature field for each month was now defined and so allowed the calculation of the anomalies for the SST data transmitted from the buoys drifting in the southern ocean. For this purpose, it was assumed that each of the 12 monthly climatic SST arrays applied to the central day of the month. To calculate the temperature at any other date, linear interpolation in time was used between the two arrays bracketing the date. To find the temperature at a given buoy position, bilinear interpolation was used based on the temperatures at the four corners of the 2 1/2° square containing

the position. If all of the four corner values were not available, no interpolation was done.

The SST information as received at MEDS was passed through a preliminary computer program which checked that the message structure was correct, (e.g. whether all fields had the correct number of digits, header fields were reasonable, etc.). Position and time information were checked for clearly erroneous values (e.g. the year must be either 1978 or 1979). Temperature observations were checked to ensure they fell within the limits of -2°C to +32.5°C. If any position or time information was incorrect or missing, or the message structure wrong, the entire message was deleted. If the temperature information was erroneous, it was deleted, but the other information was retained.

The data were then entered into a file on computer from which the data for the products produced by MEDS were extracted. For each 5-day record, the buoy information was obtained and placed on a smaller file. The next check involved the use of a graphics program written for a Tektronics terminal. The 5-day track chart and SST were displayed successively for every buoy in the file. Suspect data were identified as spikes and deleted. The number of deletions like this, as a fraction of the entire dataset, was very low. More often, the entire record for a buoy was in error, often showing a fixed temperature over the 5-days. For these, the entire temperature file was deleted. This occurred for about 12% of the data.

For a particular 5-day period, let there be n buoys for which temperature anomalies, ϕ_i, are available. The mean and variance of the anomalies are:

$$\bar{\phi} = \frac{1}{n} \Sigma \phi_i$$

$$\sigma^2 = \frac{1}{n-1} \left[\Sigma (\phi_i^2) - n\bar{\phi}^2 \right]$$

where, as before, each anomaly is made up of two parts (equation 1). Because the buoys are well separated, on average by 1000 km, the noise at each buoy will include any true short scale temperature variations as well as observational errors. As before, let the variance of the noise be given by equation 7, and assume it is constant over the whole map. Again, assume the noise is uncorrelated between buoys or the anomalies.

Because anomalies are being treated, it would be possible to estimate the covariance function directly, making use of the mean anomaly. However, for the convenience of using the same computer program as was used for the analysis of the climatic data, the structure function was calculated again. The calculation was done in a similar fashion to that described before for all pairs of buoys less than 10,000 km apart. Then, the estimated covariance function, $\hat{F}(r)$, was determined by:

$$\hat{F}(r) = \sigma^2 - \frac{1}{2} \hat{G}(r)$$

The shape of this function suggested a Gaussian curve (e.g. Fig. 260) and so was approximated by the functional form:

$$F(r) = (\sigma^2 - E) \exp\left[-\frac{1}{2}(r/r_s)^2\right]$$

where E and r_s are as before and have to be determined. If there is a nearly linear initial drop off of $\hat{F}(r)$, then the fit may be found easily by drawing a straight line through this linear portion. Then, r_s will be one half the x intercept and $(\sigma^2 - E)$ will be about 85% of the y intercept. It happened that there were large fluctuations in σ^2 and $\hat{F}(r)$ from one 5-day period to the next (although $\bar{\Phi}$ was stable). To deal with this, $\bar{\Phi}$, σ^2 and $F(r)$ were averaged over the first eight 5-day periods before E and r_s were estimated. From then on, at the end of each month all the data were used to update these values. In doing this averaging, it was assumed that the statistics of the temperature anomalies are stationary over the year. This has not been investigated closely. For the dataset from January to December 1979, $\bar{\Phi} = 0.76°C$, $\sigma = 1.02C°$, $\sqrt{E} = 0.57C°$ and $\bar{r_s} = 750$ km.

Using the statistics of E and r_s, it is possible to interpolate the temperature anomaly data onto a 61 by 61 grid. To do this, a similar procedure was followed as for the climatic data. The first step is to remove the mean, Φ, from all the anomalies for the particular 5-day period:

$$\phi_i^* = \phi_i - \Phi \quad (i = 1, \ldots, n)$$

where Φ is the mean anomaly averaged from previous 5-day periods. The covariance matrix as given in equation 5 is set up next. The shape of the covariance function is such that it is very close to zero beyond about 3,000 km. We need only include in the covariance matrix calculation, then, those buoys within this range of the grid point at which a value is to be interpolated. The covariance matrix is inverted and the estimated anomaly calculated as in equation 5, using Φ as the mean and the expected error as in equation 6. Notice that because the mean value used here, Φ, is the true mean value, the third term of equation 6 reduces to zero. These calculations are performed at each point of the 61 by 61 grid.

In addition, at each buoy position the value of:

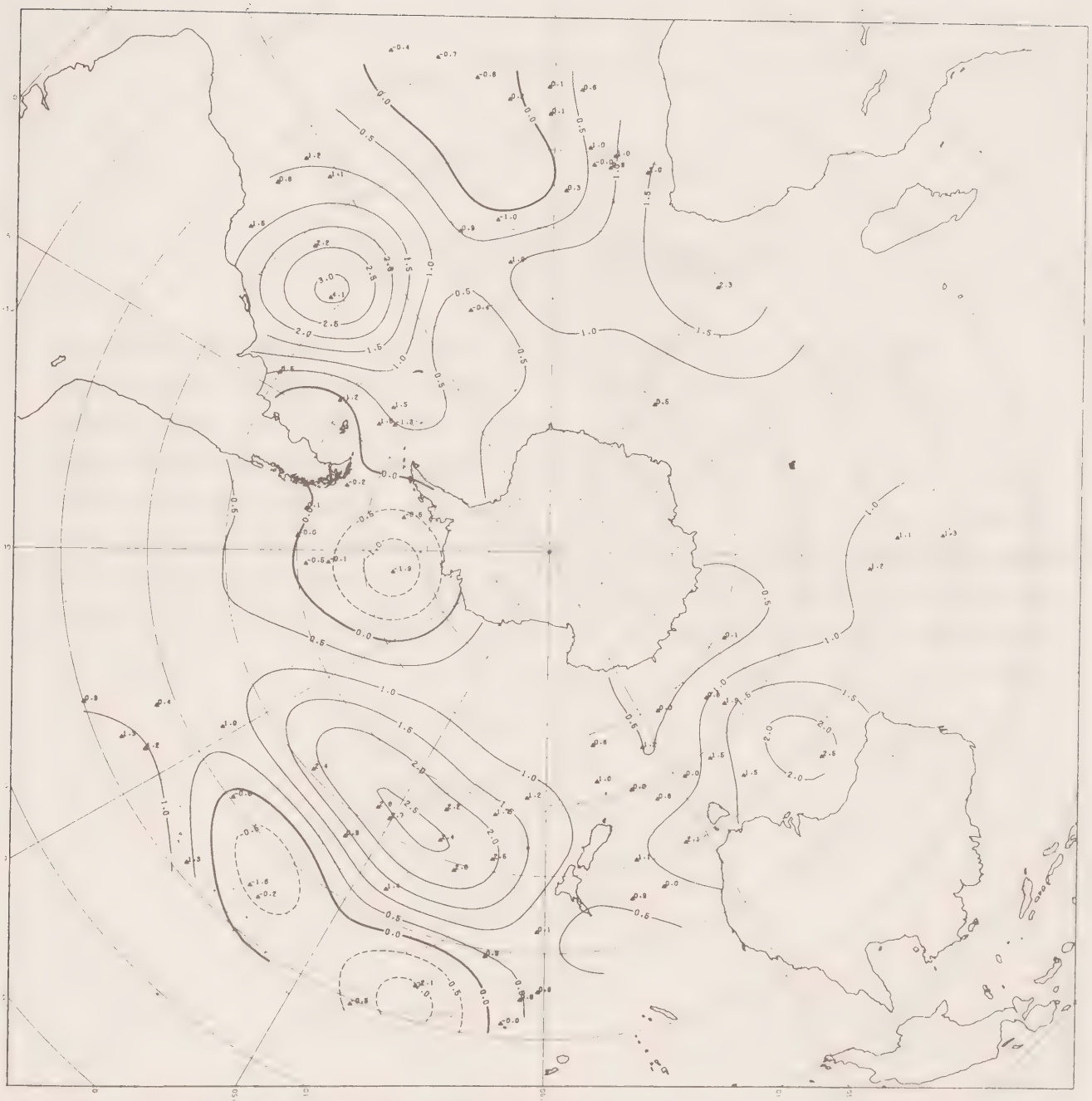
$$\lambda_i = \sum_j a_{ij}^{-1} \phi_j^* \Big/ \sqrt{a_{ii}^{-1}}$$

where ϕ_j^* is the anomaly with the mean removed, was calculated. This is the ratio of the actual to expected residual of the fit at the buoy position. If λ_i is greater than 3, there is reason for suspecting the validity of the data at the buoy position. This provided the final guide to editing of the data. At this point, the final anomaly map was contoured in 0.5C° intervals and the error map superimposed. These are presented in Figures 25-98 (*on microfiche also*).

The 5-day SST maps use the same 61 by 61 grid as the anomaly map. To obtain them, the climatic temperature was interpolated onto a 61 by 61 grid and then added to the anomaly map. The resulting values were then contoured at 1C° intervals (Figures 99-172 *on microfiche*).

SST Anomaly Map: December 28, 1978 - January 1, 1979

The number of reliably reporting buoys was 84. The average sea surface temperature anomaly was 0.76°C. There are 7 features evident on the anomaly map: 4 warm and 3 cold. Because of the sparse distribution of the buoys, only one of the features, a warm anomaly east of New Zealand (45°S, 150°W), was sampled adequately. In most cases, the extremes of the anomalies are sampled by only 1 buoy. Again, because of the buoy distribution, the boundaries of the features are not well defined in most cases, and therefore are not likely to be very stable in position. Neither the Indian nor the eastern Pacific Oceans have any reporting buoys. The peak value of the warm anomaly off Argentina (40°S, 40°W) may reflect a southern extension of the Brazil Current, although the value of the anomaly seems to be unexpectedly large.

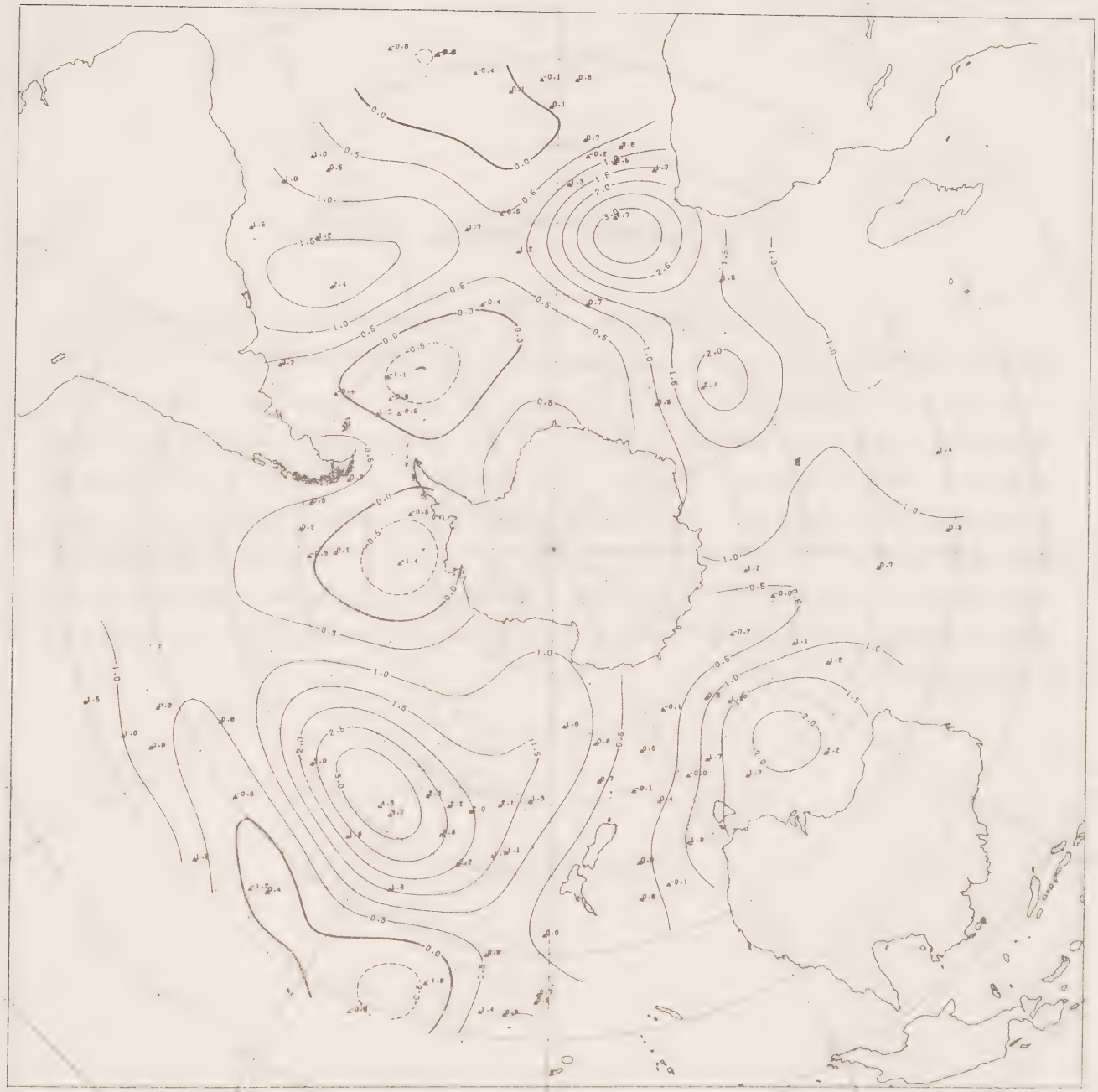


DEC 28 - JAN 1/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE. CANADA

SST Anomaly Map: January 2 - 6, 1979

The number of reporting buoys is 98. The average sea surface temperature anomaly is 0.83°C. The increased number of buoys has improved the definition of some of the features. We find that the warm anomaly south of Africa now shows 2 peaks. The cold anomaly southwest of Cape Horn has diminished in size, so that now Drake Passage has a slight warm anomaly. A cold anomaly has developed in the Weddell Sea area, as hinted at from the previous map. The intense warm anomaly east of Argentina has diminished substantially from last time, justifying the skepticism expressed in the peak recorded anomaly last time. An intense warm anomaly has developed southwest of Africa.

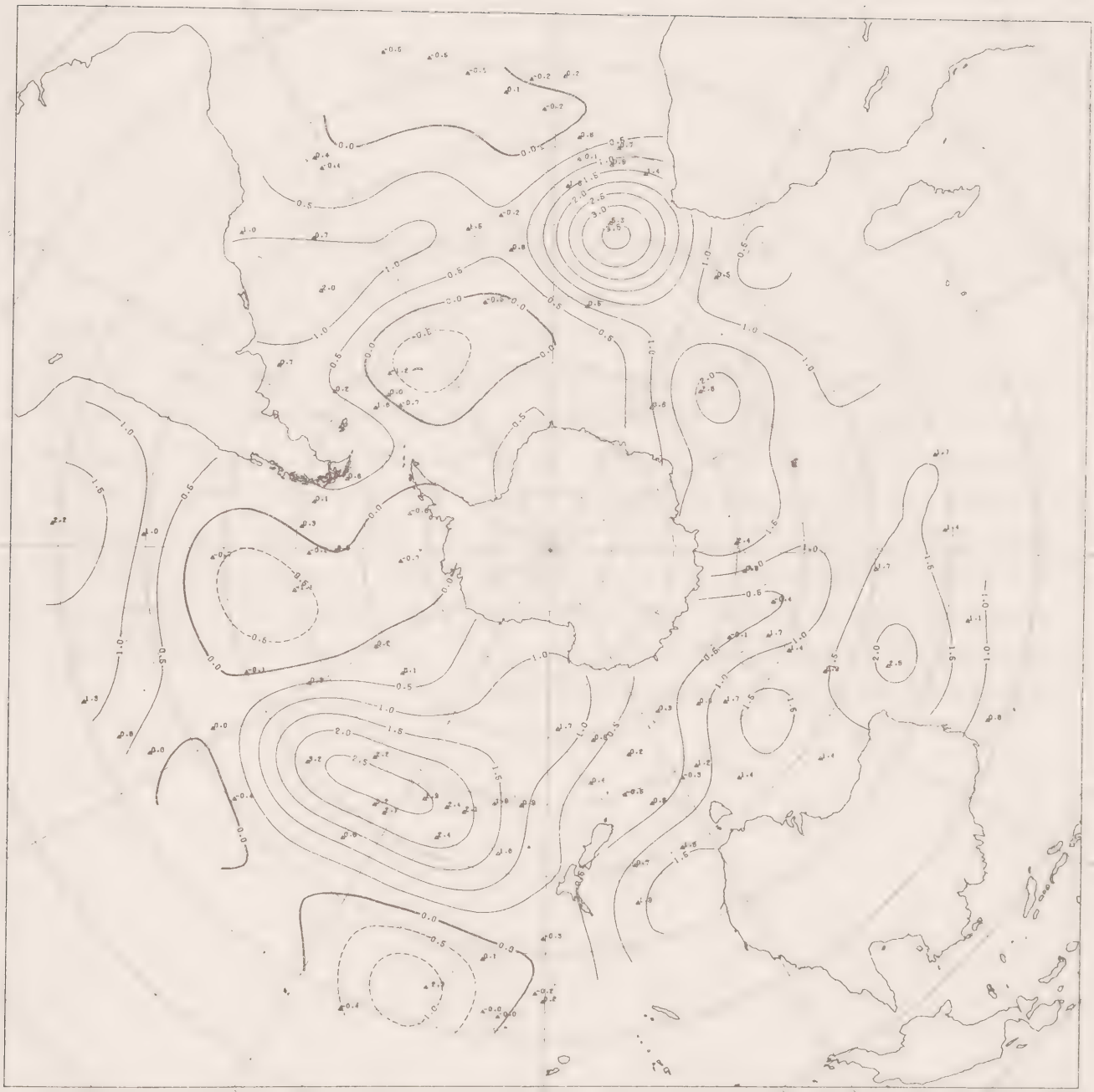


JAN 2-6/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: January 7 - 11, 1979

The number of reporting buoys is 102. The average sea surface temperature anomaly is 0.74°C. Although the total number of reporting buoys has only increased by 4, the areal coverage has improved substantially. The warm anomaly east of New Zealand has remained stable, as have most of the other features. The cold anomaly southwest of Cape Horn has expanded in area, probably reflecting better buoy coverage in the area. The strong warm anomaly southwest of Africa has become even stronger, with peak values increasing 0.5 degrees. A new warm anomaly has appeared in the eastern Pacific, and probably reflects the improved coverage there. Coverage on the western coast of Australia has improved slightly, but the western Indian Ocean is still poorly sampled.

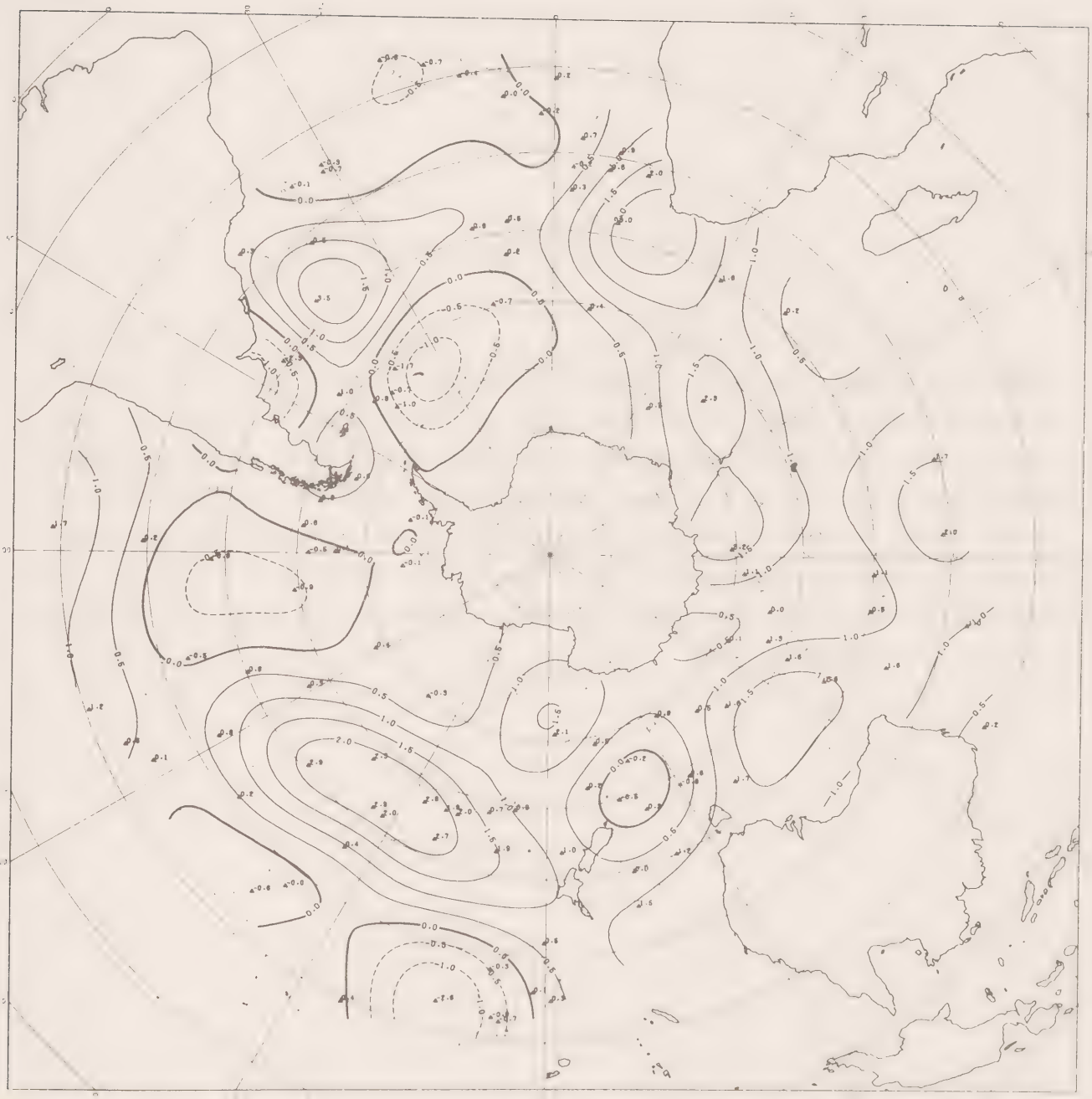


JAN 7-11/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: January 12 - 16, 1979

There are now 107 reporting buoys. The average sea surface temperature anomaly is 0.58°C. The large scale features of the map have been preserved. The relatively cold band of water south of New Zealand has become a small cold anomaly. The warm anomaly southwest of Africa has cooled appreciably. The cold anomaly of the equatorial Atlantic has increased in area to touch the Brazil coast. The cold anomaly west of Chile has penetrated 5° farther north than the last time. Although 5 new buoys are reporting this period, they are not in gaps in the present coverage. At present, the central southern Indian Ocean is still largely unsampled. A cold anomaly appearing off the coast of Argentina is due to a 3° fall in reported temperature by 1 buoy (17623); therefore, its existence is unreliable.



JAN 12-16/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Maps: January 17 - 21, 1979

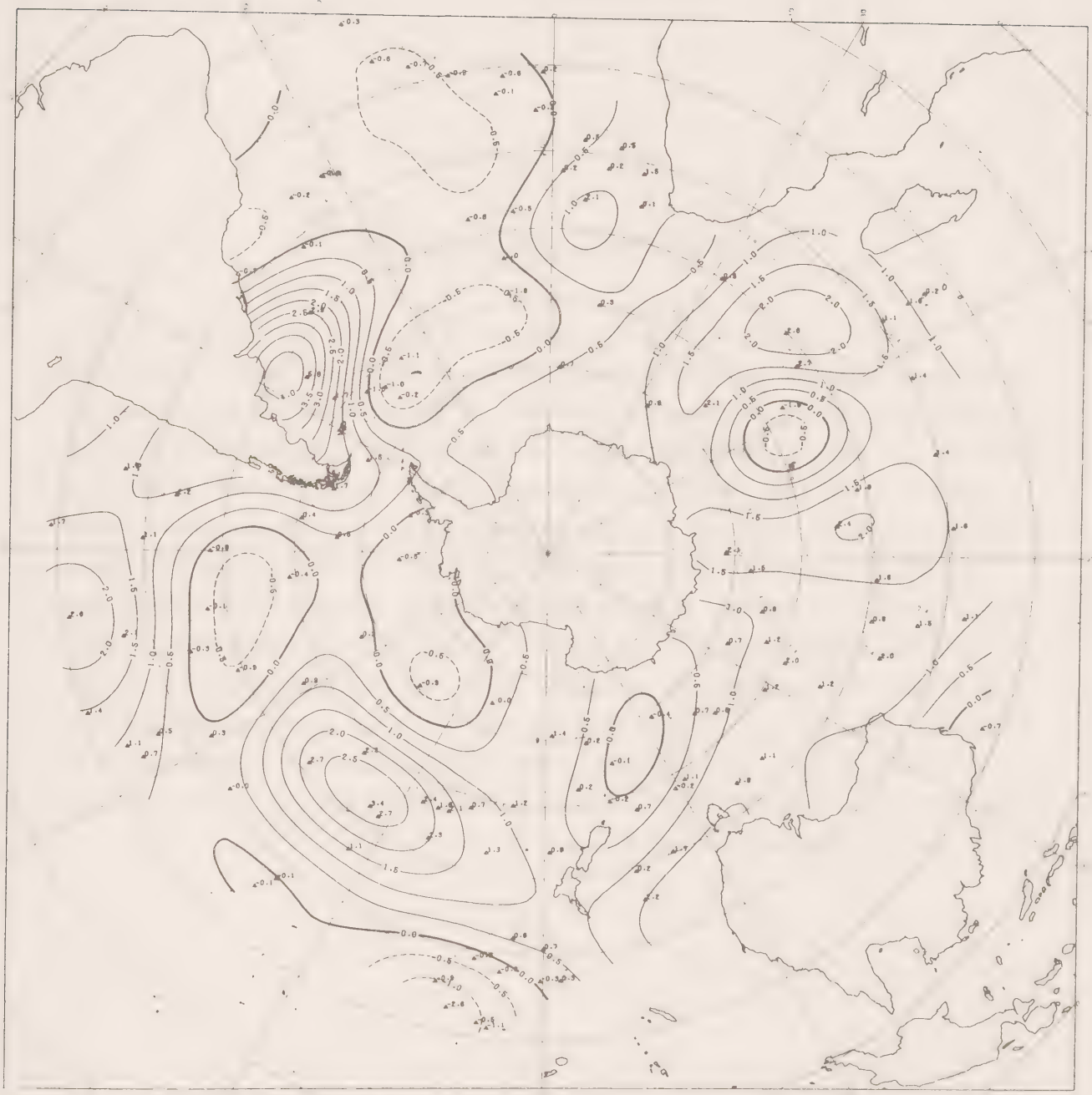
The number of reporting buoys is 119. The average sea surface temperature anomaly is 0.65°C. The major change in the anomaly map has been in the southern Indian Ocean. The warmer water formerly near 90°W has now become relatively cooler. Also, a cooler pool of water has appeared at 45°S, 60°E, due to the temperature report from a new buoy, 14630. In general, the features in the entire Indian Ocean do not appear stable, and this implies the sampling is still not adequate. The other major change has been the disappearance of the warm anomaly southwest of Africa. The reported temperature of buoy 74626 has fallen 2.6° since the last time. The remaining map has remained fairly stable.

JAN 17-21/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: January 22 - 26, 1979

The number of reporting buoys is 129. The average sea surface temperature anomaly is 0.69°C. The warm anomaly east of Argentina (40°S, 60°W) has become warmer, with buoy 17623 reporting an anomaly 4.3° higher. The eastward extent of this warm anomaly has been curtailed by the union of the cold anomalies of the Atlantic and Weddell Sea regions. Cold anomalies reported by 2 buoys (17755 and 17760) appear to be responsible for this. Some features have developed in the Indian Ocean. Buoy 14630 reports a cold anomaly of -1.8°. This is the only report of a cold anomaly from the area, so it must be considered with some doubt. Immediately adjacent to the west, warm anomalies reported by buoys 17630 and 14633 generate a warm peak in the map. Finally, the relatively cool region south of New Zealand has redeveloped a cold anomaly.



JAN 22-26/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: January 27 - 31, 1979

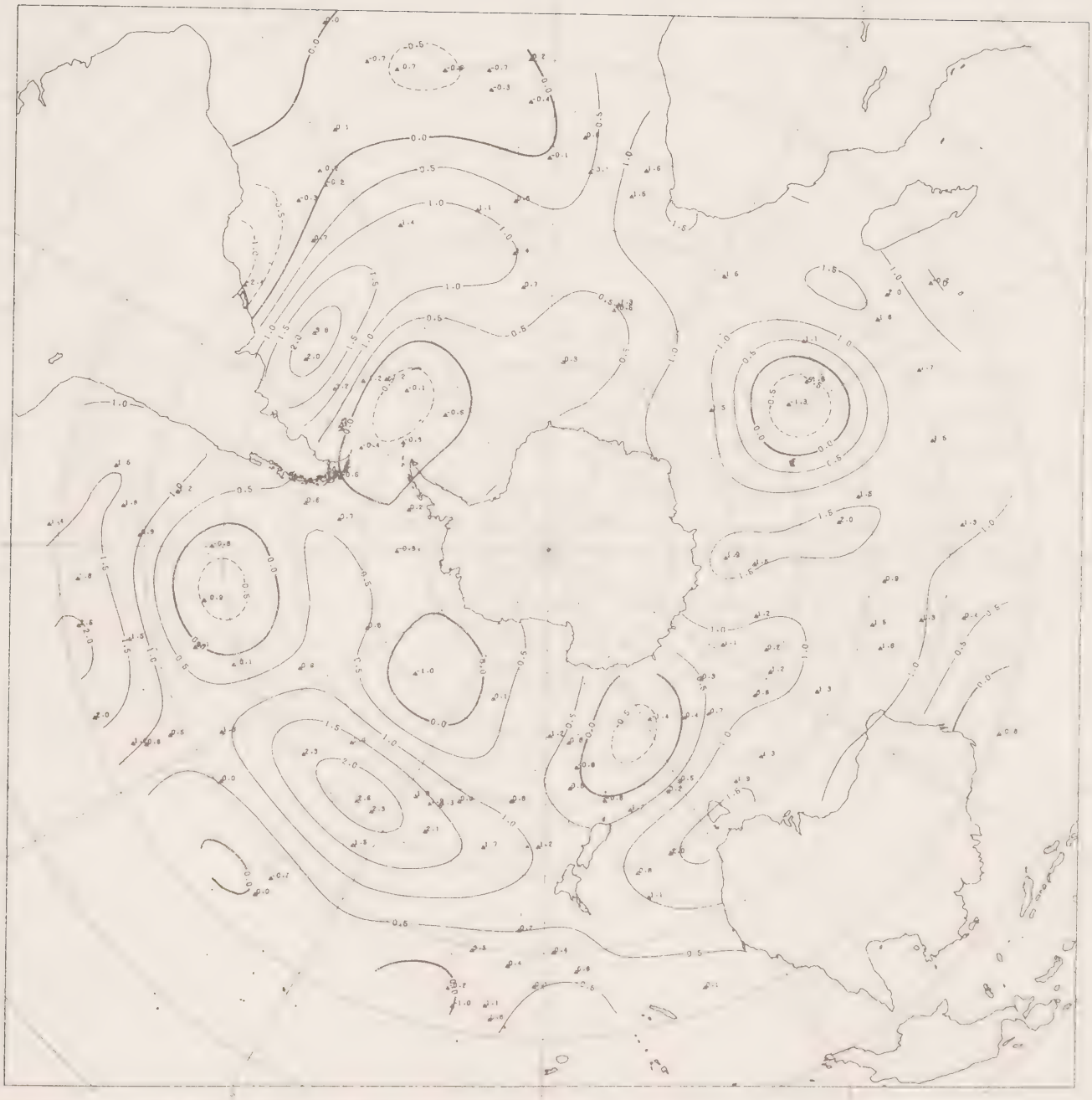
The number of reporting buoys is 136. The average sea surface temperature anomaly is 0.64°C. The main change has taken place in the Indian Ocean. The warm anomalies have smoothed out such that all the water south of 30°S is 1°C above the climatic mean. The exception is a pocket of cold water sampled only by buoy 17629. This buoy has consistently reported a negative anomaly, while neighbouring buoys (the closest within about 500 km) do not. Until a second buoy reports a negative anomaly, the reality of this feature is dubious. The other major change has been the split of the cold anomalies of the Weddell Sea (55°S, 30°W) and the Atlantic (30°S, 30°W). This has occurred because buoys 17755 and 17756 have reported temperatures 0.5°C warmer than previously. The eastward extension of the warm anomaly off Argentina (40°S, 50°W) is also a consequence of this. The extreme of this warm anomaly, as reported by buoy 17623, has cooled 1.7°C, while the buoy has moved cyclonically north and east. The remaining features are fairly stable.

JAN 27-31/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: February 1 - 5, 1979

The number of reporting buoys is 133. The average sea surface temperature anomaly is 0.66°C. A major change this time has been buoy 14633 (43°S, 55°E) reporting a negative anomaly in the Indian Ocean. This is now in the neighbourhood of buoy 14630 and apparently confirms the existence of this feature. The warm anomaly east of Argentina (40°S, 50°W) has extended to the east, and in the east, both north and south as well. This is primarily because buoys 17755, 17610 and 17760 all report warmer anomalies. The cold anomaly in the Weddell Sea region (55°S, 50°W) has shifted westward to include all of Drake Passage. Negative anomalies reported by buoys 54607 and 54603 appear to be responsible. Finally, the cold anomaly of the western Pacific (25°S, 135° - 165°W) appears to be moving northward. Those buoys still reporting cold anomalies have warmed about 0.5°C. Buoy 54607 appears to have grounded on the islands of Cape Horn.

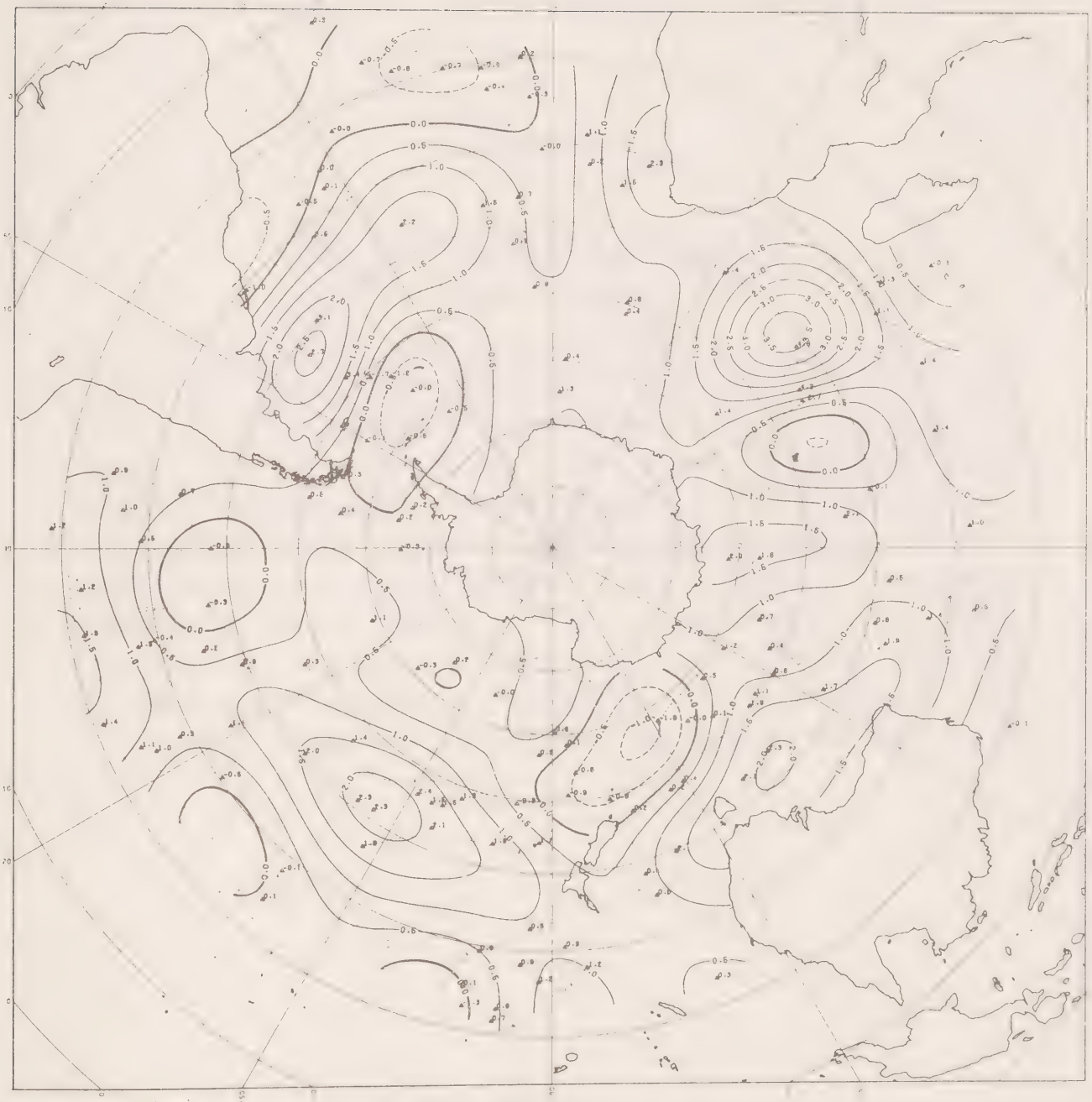


FEB 1-5/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (100B3) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: February 6 - 10, 1979

The number of reporting buoys is 139. The average sea surface temperature is 0.69°C. The most outstanding changes have occurred in the Indian Ocean. A very warm anomaly has appeared at 40°S, 45°E. Peak anomalies exceeding +4°C are reported by buoys 14633 and 17630. Previously, buoy 14633 reported a -2.4°C anomaly. This wide variation casts some doubt on the quality of the temperature sensor. Other features have also appeared in the Indian Ocean and the ocean just south of Australia. The warm anomaly near Argentina (40°S, 50°W) has warmed in its eastern regions, with buoy 17767 reporting an anomaly 0.6°C warmer. A consequent areal reduction in the cold Atlantic anomaly (20°S, 0° - 50°W) has occurred. Finally, the cold anomaly off Antarctica (55°S, 140°W) has all but vanished, with buoy 54652 reporting 0.7°C warmer than last time, and a new buoy (54610) close by reporting a slightly positive anomaly.

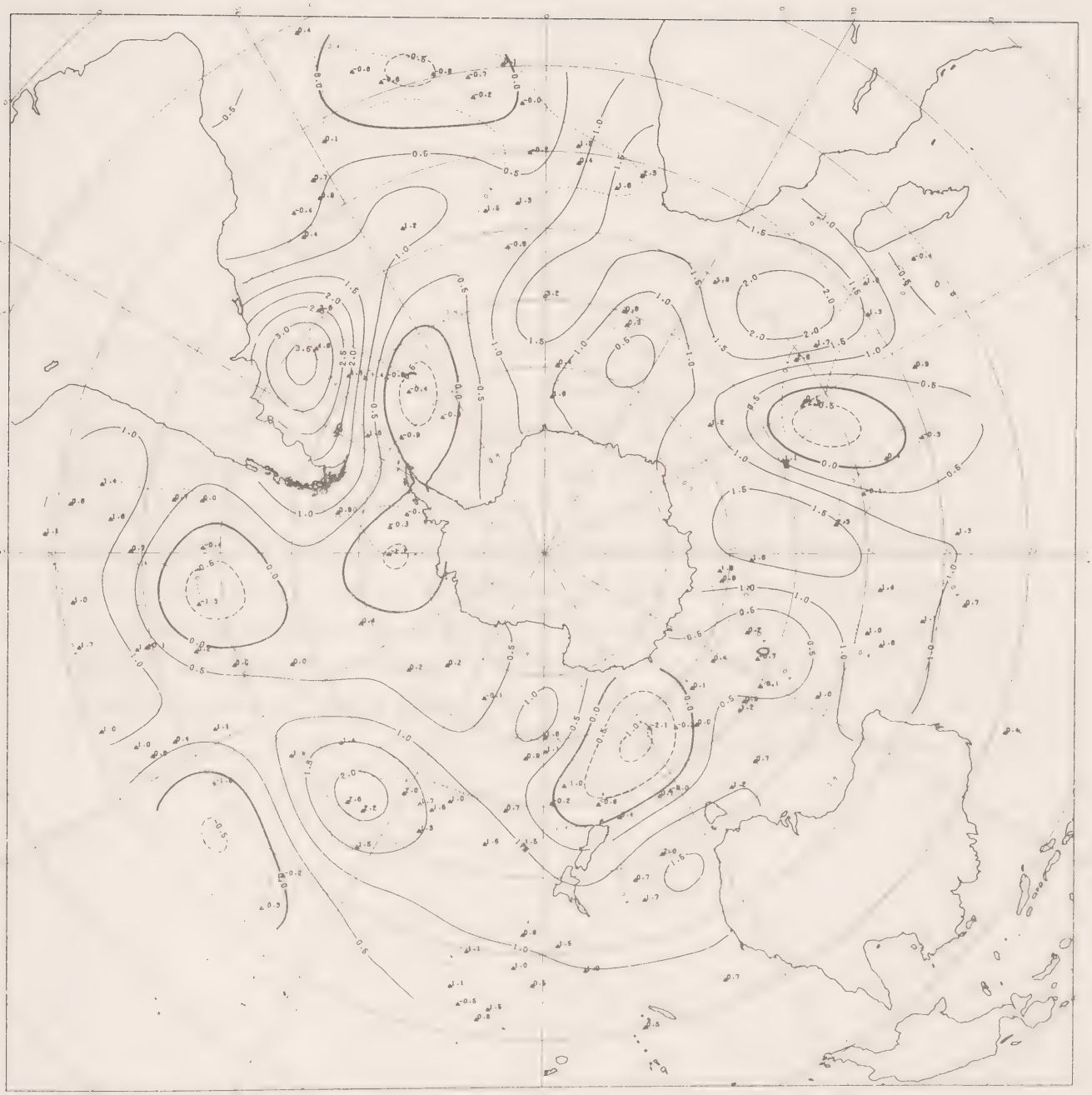


FEB 6-10/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map - February 11 - 15, 1979

The number of reporting buoys is 144. The average sea surface temperature anomaly is 0.70°C. A noticeable change has been the western extension of the warm anomaly east of New Zealand (40°S, 145°W). This is due to increased anomalies, both north and west of New Zealand. The very warm anomaly in the Indian Ocean (40°S, 45°E) has cooled considerably. Buoy 14633 reports a 4.2°C cooler anomaly, and buoy 17630 a 2.3° cooler anomaly than last time. The whole tip of South Africa has water 1.5° warmer than the climatic mean. The cold anomaly of the Atlantic (20°S, 15°W) shows a greatly reduced area, primarily because buoy 17655 failed to report reliable temperatures. The westward extension of this anomaly was caused by the cold values reported by this buoy alone. The other features have remained fairly stable compared to last time.

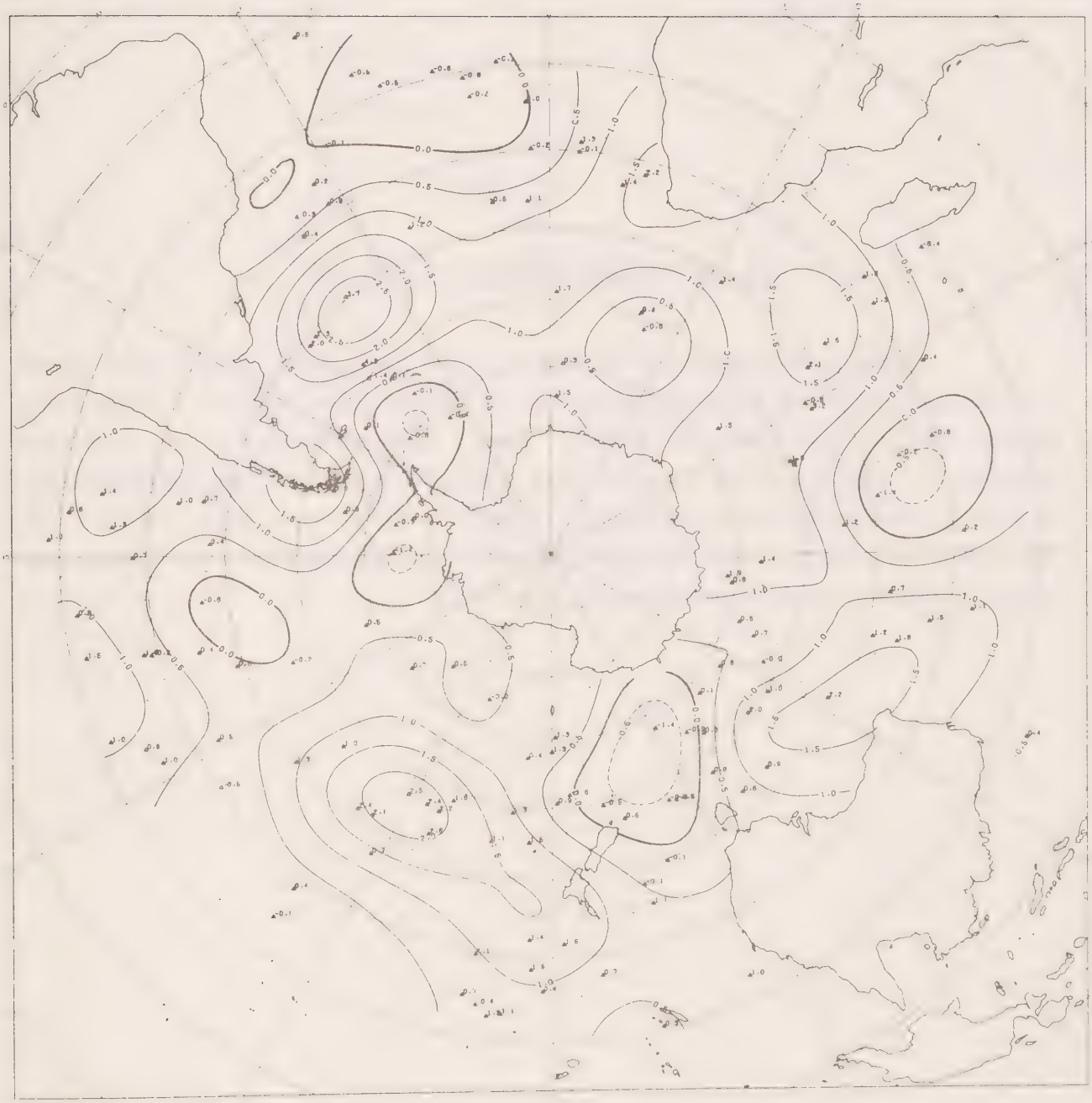


FEB 11-15/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: February 16 - 20, 1979

The number of reporting buoys is 144. The average sea surface temperature is 0.72°C. The most notable feature is the disappearance of the cold anomaly in the Pacific (formerly 20°S, 165°W). This is due to a warming of the waters north of New Zealand. The warm anomaly east of Argentina (40°S, 45°W) has increased in area, and a band of water 1°C above the climatology extends across the Atlantic from South America to Africa at about 45°S. The waters of Drake Passage also appear to have warmed slightly. The cold anomaly of the Indian Ocean has shifted to 35°S, 80°E primarily because of the anomaly reported by buoy 14630 being 2.3° warmer. An area of slightly cooler has developed south of Africa (55°S, 25°E), with buoy 74639 now reporting a cold anomaly. Notice that buoy 17655 seems to have grounded off southern Brazil.

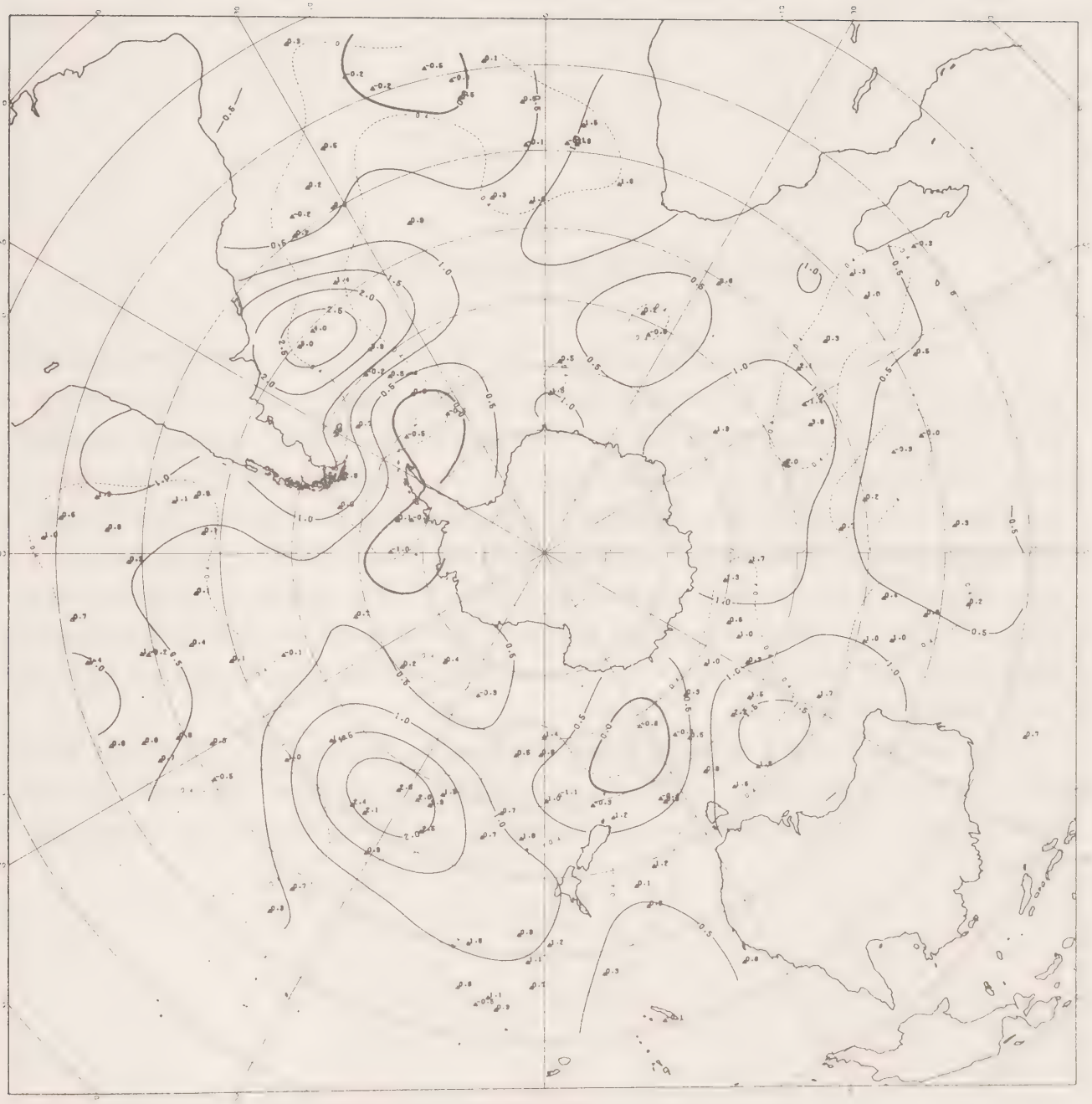


FEB 16-20/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: February 21 - 25, 1979

The number of reporting buoys is 143. The average sea surface temperature anomaly is 0.75°C. The most notable change in the map from last time is an apparent general warming over the whole southern ocean. This has caused 2 cold anomalies (formerly at 40°S, 100°W and 35°S, 80°E) to disappear entirely. All of the other areas showing cold anomalies have been reduced from the previous chart. All of the structure that was present in the Indian Ocean in the period of February 6 - 10 has disappeared, leaving a map with average anomalies of 0.5°C to 1°C.



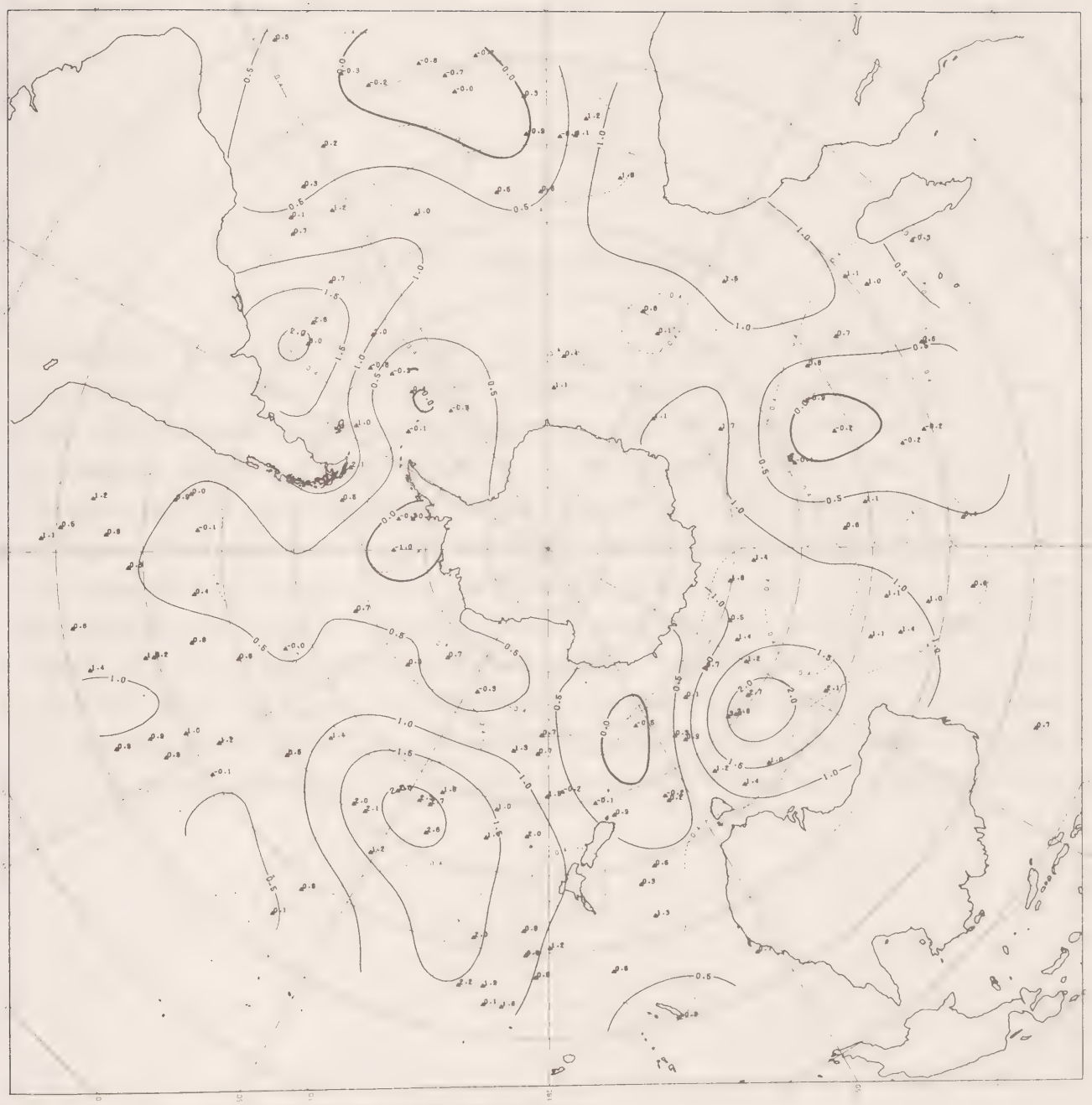
FEB 21-25/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: February 26 - March 2, 1979

The number of reporting buoys is 145. The average sea surface temperature anomaly is 0.79°C. Since last time, a cold anomaly has reappeared in the Indian Ocean at 40°S, 70°E. This is primarily due to buoy 14633 reporting an anomaly 4°C cooler than last time. The cold anomaly in the Atlantic Ocean (25°C, 15°W) has expanded in area. Again, this seems to be the result of a single buoy, 17753, reporting a cold anomaly 0.8°C cooler than in the previous 5-day period. Otherwise, the anomalies reported by the other buoys encompassed by this cold anomaly are fairly stable. The cold anomaly of the Weddell Sea region (60°S, 40°W) has all but vanished. Finally, the warm anomaly south of Australia (50°S, 125°E) has become even warmer. The extreme anomaly reported by buoy 56638 is 1.2°C warmer than last time.

Although there were 189 buoys reporting for the time period, only 145 were used in the temperature charts. The remaining buoys were not used because approximately 15 were outside the map boundaries, and 19 had temperatures which were suspect.

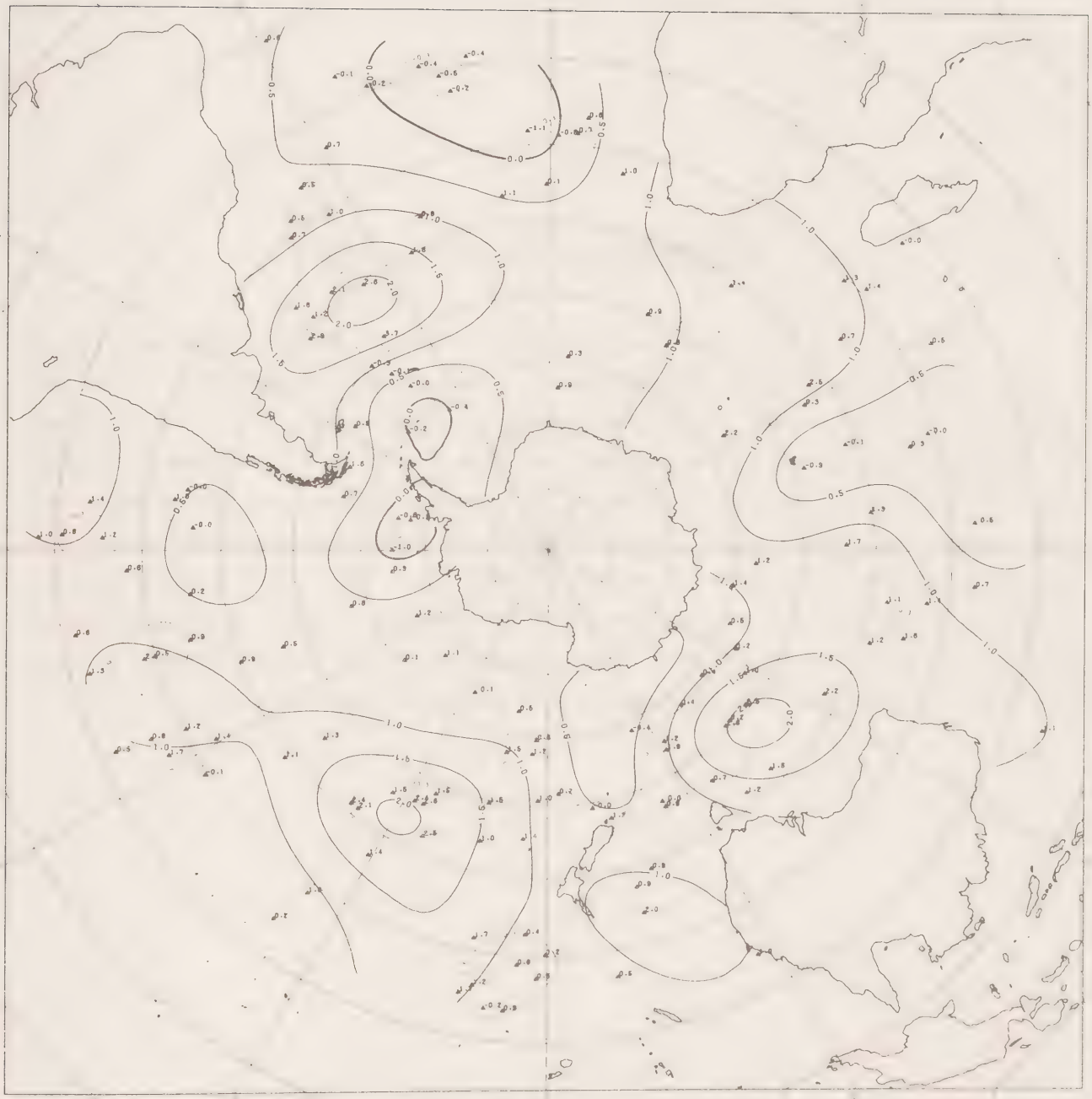


FEB 26-MAR 2/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: March 3 - 7, 1979

The number of buoys reporting is 148. The average sea surface temperature anomaly is 0.89°C. Since the last time period, the cold anomaly south of New Zealand (165°E, 55°S) has disappeared and is now only a minimum in the warm anomaly field. Only one buoy (14624) reports a cold anomaly in this region. The cold anomaly formerly at 70°E, 45°S has also been replaced by only a minimum warm anomaly. This has happened despite cold anomalies still reported by most of the buoys. Only buoy 14634 reports a warm anomaly, but its location with respect to the other seems to be responsible for eliminating cold anomaly contours being drawn. The cold anomaly of the Weddell Sea region (40°W, 50°S) has expanded slightly, with buoy 17606 reporting a 0.4° cooler anomaly than last time. Finally, the warm anomaly east of Argentina (40°W, 45°S) has increased in area, and the extreme anomaly reported by buoy 17608 is 0.7° higher than the previous extreme. The anomaly reported by this buoy is 1.7° warmer than last time.

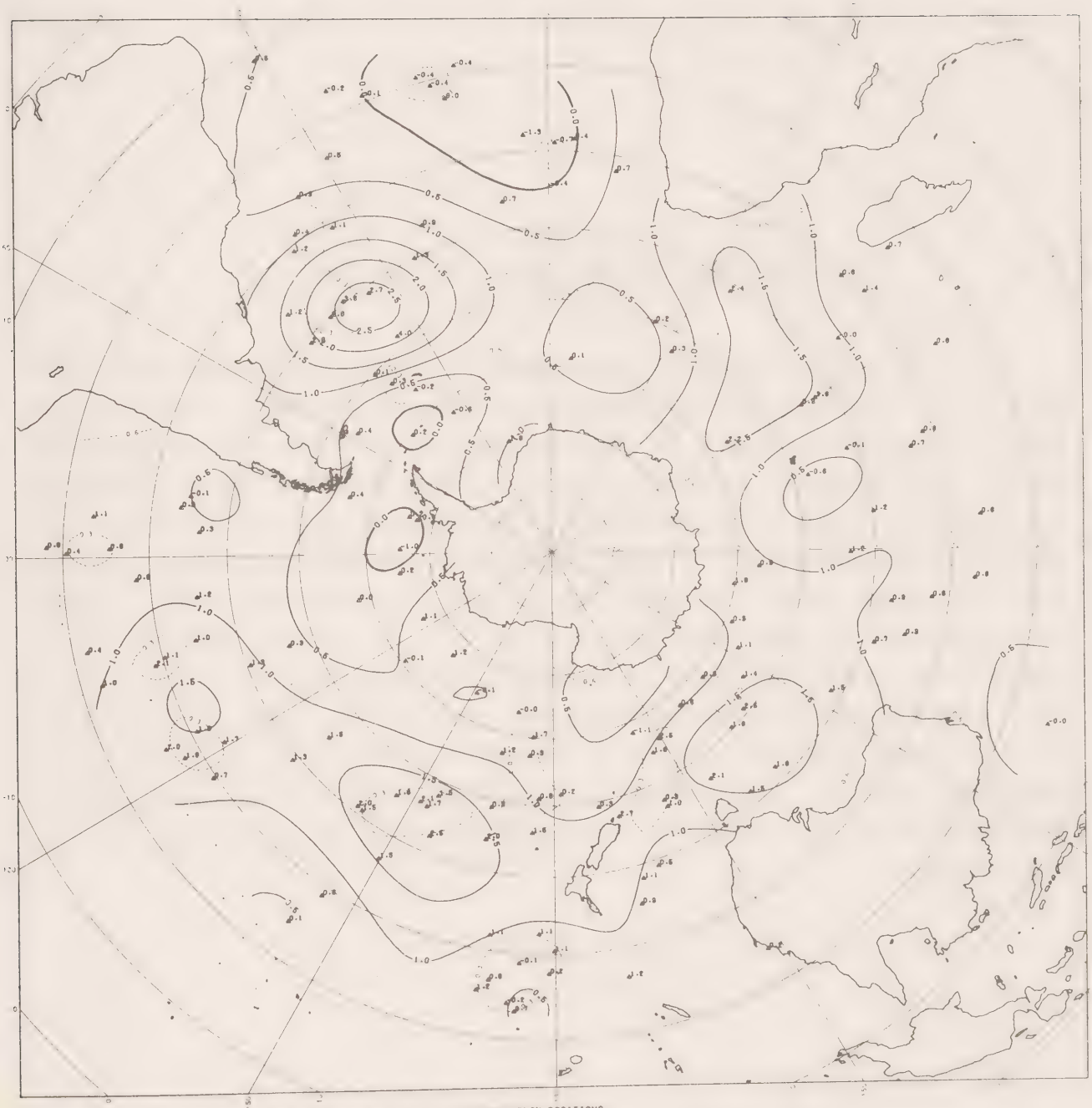


MAR 3-7/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: March 8 - 12, 1979

The number of reporting buoys is 144. The average sea surface temperature is 0.89°C. Since the last report, the warm anomaly east of New Zealand (40°S, 150°W) has cooled off, with only 1 buoy (54627) now reporting an anomaly greater than 2.2°. It has also extended more to the east to include an extreme at 30°S, 110°W. The warm anomaly south of Australia (45°S, 135°E) has cooled. This may be because buoy 56635, which last time reported an anomaly of 3.2°, failed to report this time. Otherwise, the buoys in this region report about the same anomalies as last time. The warm anomaly east of Argentina (45°S, 40°W) has warmed, with two buoys (74617 and 17608) reporting anomalies greater than 3.5°. The cold anomaly of the Atlantic (30°N, 10°W) has increased in area, with buoys in the region reporting slightly cooler anomalies than last time.

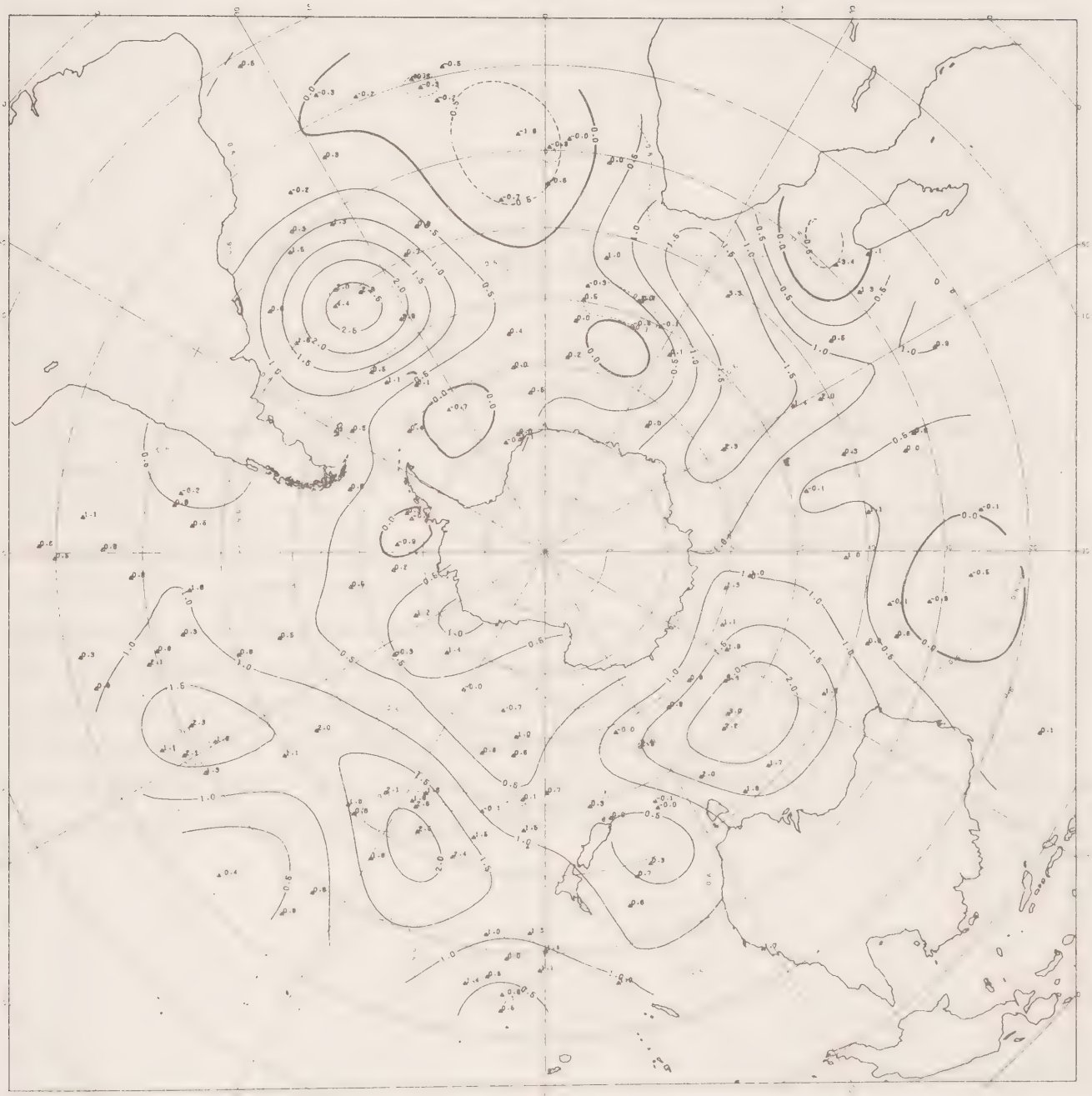


MAR 8-12/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: March 13 - 17, 1979

The number of reporting buoys was 160. The average sea surface temperature was 0.78°C. There have been some substantial changes since last time. The Indian Ocean now shows two cold anomalies, one at 30°S, 45°E, and the other at 30°S, 90°E. The former is the consequence of one buoy, 14622, reporting a cold anomaly 4° colder than last time. The reality of this feature must be considered doubtful. The other cold anomaly of the Indian Ocean encompasses four buoys reporting cold anomalies, all of which were slightly warmer last time. The cold anomaly of the Atlantic (30°S, 0 - 30°W) has expanded in area, with an extreme anomaly of -1.6°. The warm anomaly east of Argentina (40°S, 40°W) has approximately the same areal extent, but the extreme value of 4.4° reported by buoy 17623 is 0.4° colder than last time. The warm anomalies of the Pacific, at 30°S, 120°W and 40°S, 160°W, have both warmed slightly. Finally, relatively cooler water appears to be showing in the tropical Pacific at about the same longitudes (135°W and 175°W) as those at which cold anomalies existed in January and early February anomaly maps.

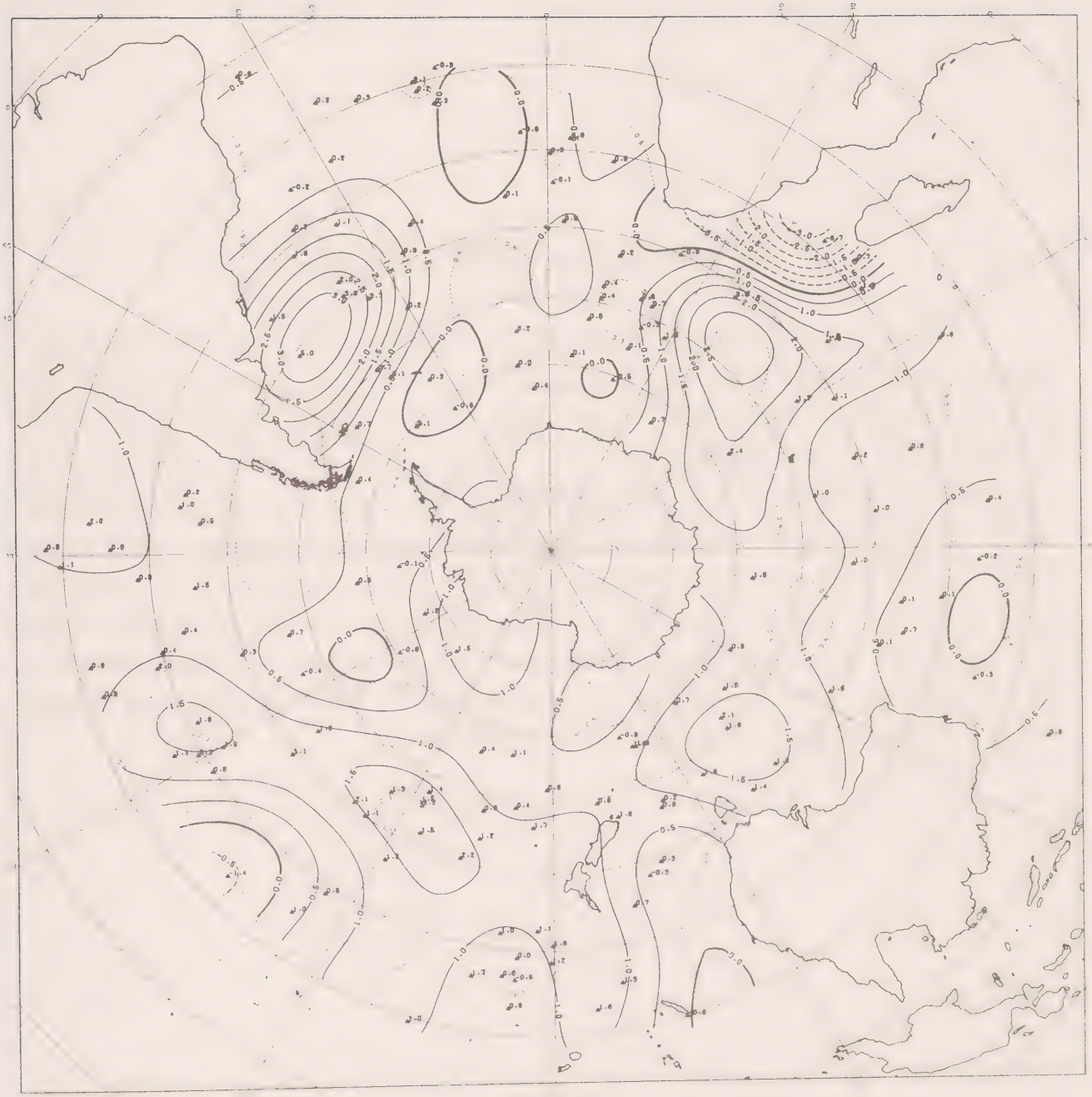


MAR 13-17/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: March 18 - 22, 1979

The number of reporting buoys is 164. The average sea surface temperature anomaly is 0.81°. The extreme anomaly reported for the anomaly east of Argentina (40°S, 50°W) has increased from 4.4° to 5°, reported by buoy 17764. This anomaly is 3.2° higher than this buoy reported last time. The cold Atlantic anomaly at 30°S, 10°W appears to have warmed, since now only 3 buoys report cold anomalies, where before 11 did. The average warming required, however, is $\leq 0.5°$. Buoy 14622 reports a very cold anomaly of -6.7° south of Madagascar. This is 3.3° cooler than last time and must be considered suspect. It has been retained simply because until now, it had appeared to be reporting temperatures reliably. The effect of leaving it in has been to force a warm anomaly at 45°S, 45°E further south, so that it is no longer centered about the extreme of 3.6° reported by buoy 17752. The warm anomaly south of Australia (50°S, 135°E) has cooled slightly, as has the warm anomaly east of New Zealand (40°S, 150°W). A cold anomaly has reappeared in the Pacific at 25°S, 135°W on the strength of buoy 17634 reporting a cold anomaly of -1.4°.

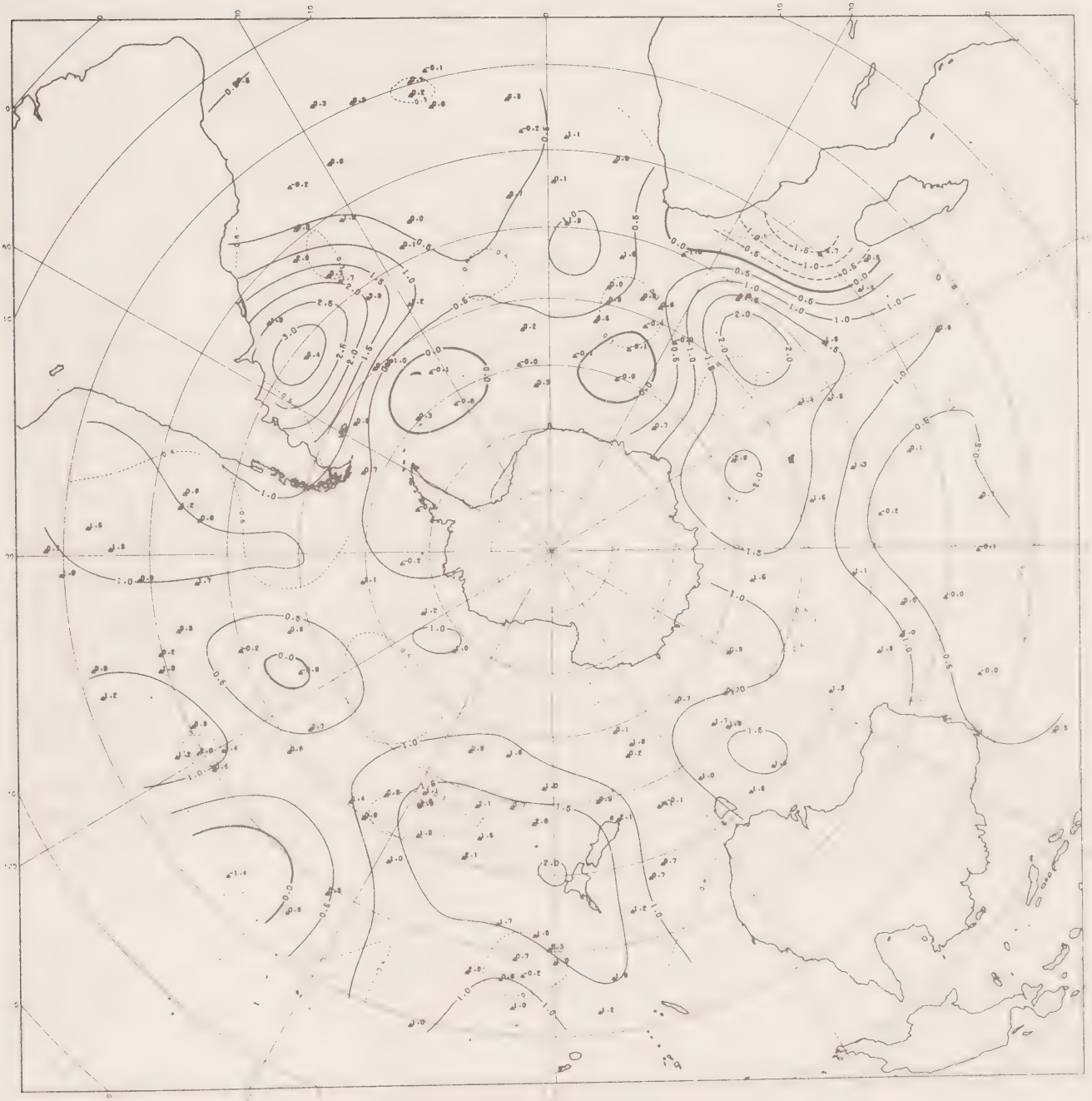


MAR 18-22/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: March 23 - 27, 1979

The number of reporting buoys is 161. The average sea surface temperature anomaly is 0.84°C. One of the biggest changes since last time has been the disappearance of the cold anomaly of the Atlantic (formerly at 25°S, 10°W). Only three widely-separated buoys report cold anomalies now. In particular, the buoys near 0°W show anomalies warmer than last time by about 0.5°. The warm anomaly east of New Zealand (40°S, 180°W) has greatly expanded the area enclosed by the 1.5° contour. Many of the buoys near New Zealand show warmer anomalies, with the largest change of 1.1° shown by buoy 17641. Buoy 14622 (30°S, 45°E) still shows a very cold anomaly, but it has warmed 2.0° since last time. Comments made last time concerning this buoy still seem appropriate. The warm anomaly south of Australia (45°S, 135°E) is diminishing in size, with a general cooling showed by all buoys of the region.

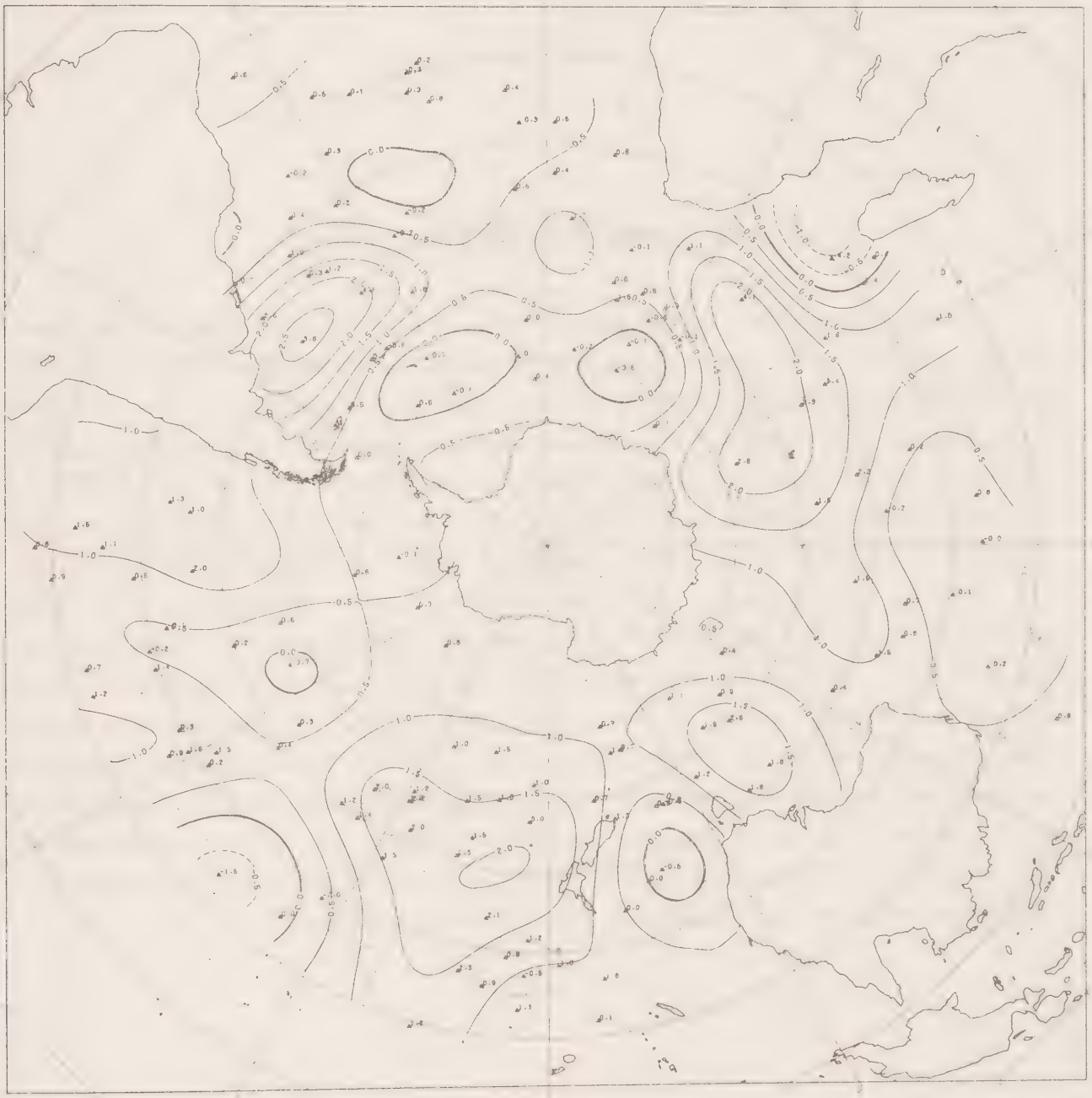


MAR 23-27/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: March 28 - April 1, 1979

The number of reporting buoys is 158. The average sea surface temperature anomaly is 0.81°C. Since last time, the cold anomaly in the Pacific (25°S, 135°W) has become colder. This is primarily because buoys 17635 and 17636, slightly to the west, have both cooled about 0.4°. The cold anomaly formerly in the Atlantic at 25°S, 10°W has reappeared, but its existence is tenuous. Its apparent position has shifted south to the region of buoys 17658 and 17767, both reporting slightly cold anomalies. The cold anomaly south of Madagascar reported by buoy 14622 persists but has warmed slightly. This buoy has been circling in this region for about the last 15 days, which is also the time it has reported cold anomalies. Buoy 17629, just south of Africa, which previously reported an anomaly of -1.6°, has warmed 2.7°. The warm anomaly to the south (at 45°S, 45°E) shows a greater extreme than last time (at buoy 17752). The cold anomaly in the Weddell Sea (60°S, 30°W) has grown slightly with the cooler anomalies to the east reported by buoys 74634, 74641 and 74650. A cold anomaly has appeared just east of Australia (35°S, 160°E) with the dramatic cooling reported by the 3 buoys in the area.



MAR 28 - APR 1/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: April 2 - 6, 1979

The number of reporting buoys is 162. The average sea surface temperature anomaly is 0.7°C. Since last time, the warm anomaly east of New Zealand (45°S, 170°W) has cooled slightly and shifted to the west. The extreme anomaly is 0.2° cooler. The cold anomaly between Australia and New Zealand has disappeared, with only one buoy, 14626, reporting a cold anomaly. Buoys 56616, 56618 and 56619 have warmed an average of 0.6°. The warm anomaly south of Australia (45°S, 135°E) has cooled, and a cold anomaly has developed even further south at 60°S. This is the result of buoys 56649, 56626 and 56625 now reporting cold anomalies. The cold anomaly south of Madagascar (30°S, 40°E) persists, and buoy 14622 reports a 0.8° colder anomaly. The larger warm anomaly south of this (45°S, 30° - 60°E) is fairly stable, although the extreme, reported by buoy 17752, is 0.7° cooler. The cold anomaly in the Atlantic (35°S, 20°W) is no more certain than last time. The cold anomaly of the Weddell Sea (60°S, 0° - 90°W) has expanded greatly to enclose Drake Passage in a cold anomaly. This has been accomplished by buoys 54604, 54615 and 54613 all reporting cooler negative anomalies. The warm anomaly east of Argentina (45°S, 40°W) has shifted to the east. The most dramatic change is reported by buoy 17764, which recorded an anomaly 3.9° cooler than last time.

APRIL 2-6/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: April 7 - 11, 1979

The number of reporting buoys is 168. The average sea surface temperature anomaly is 0.77°C. Since last time, we find the cold anomaly formerly at 25°S, 145°W has gone. The warm anomaly east of New Zealand (45°S, 170°W) is stable in its coverage, although the extreme, reported now by buoy 17640, is 0.4° cooler. The cold anomaly south of Madagascar (25°S, 40°E) has warmed from -5.0 to -3.7. The warm anomaly south of this has become warmer. This is mainly the result of a new buoy, 14639, reporting an anomaly of 4.1°. The extreme reported by buoy 17752 was 0.7° cooler. The cold anomaly of the Weddell Sea (60°S, 30°W) has pushed northwards at its eastern limit because buoy 17765 reports an anomaly of -1.2°, some 1.1° cooler than last time. The position of the extreme in the warm anomaly east of Argentina (35°S, 50°W) has shifted to the west to centre on buoy 17653. Buoy 17657, which formerly reported the extreme, has cooled 0.7° since last time. Buoy 54604 has moved east from Cape Horn and now reports a warm anomaly. For this reason, the cold anomaly occupying Drake Passage last time has been replaced by water slightly above the mean climatic temperature.

APRIL 7-11/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: April 12 - 16, 1979

The number of reporting buoys is 169. The average sea surface temperature anomaly is 0.76°. One of the most noticeable changes since last time has been the expansion of the area covered by the cold anomaly in the Weddell Sea region (60°S, 20°E - 120°W). The cold anomalies on either side of the Antarctic Peninsula have joined. The cold anomaly to the west of the Peninsula (65°S, 90°W) has cooled 0.9° in its extreme value. The cold anomaly south of Australia (60°S, 120°E) has also expanded to the east, and its extreme has cooled 1.1° since last time. In the New Zealand area (35°S, 160°E), a cold anomaly has appeared as the result of buoys 56616 and 56618 reporting cold anomalies on average 0.9° cooler than last time. The cold anomaly reported by buoy 14622 at 25°S, 40°E has warmed 0.9° since last time as the buoy continues to move toward the African coast. The warm anomaly south of this (at 35°S, 55°E) has elongated its peak, and the extreme has cooled 2.2°. The warm anomaly east of Argentina (40°S, 50°W) has warmed, with the extreme reported by buoy 17653 being 0.6° warmer than last time.

APRIL 12-16/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: April 17 - 21, 1979

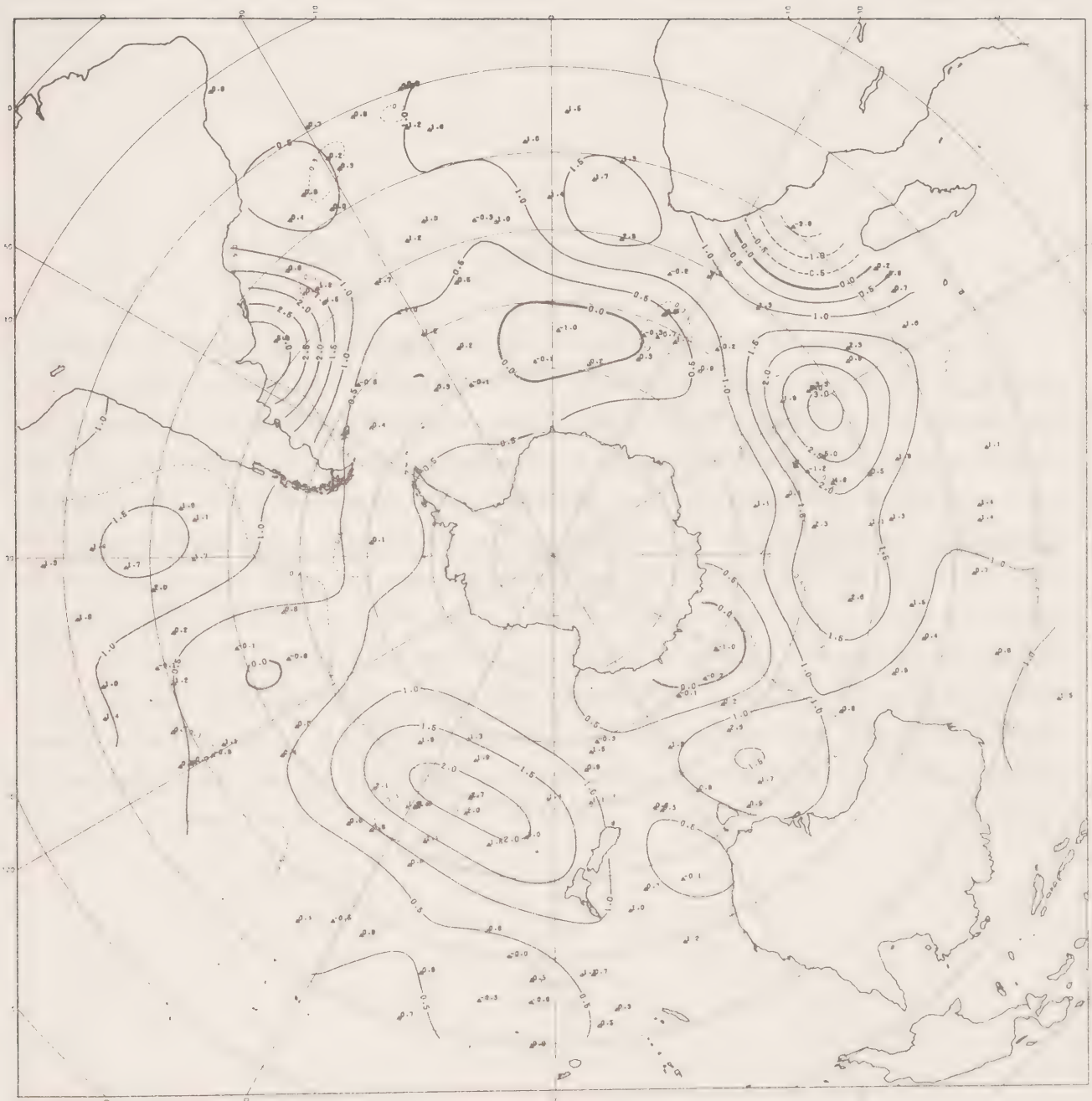
The number of reporting buoys is 167. The average sea surface temperature anomaly is 0.83°C. The May climatology is starting to influence the maps. Because the data is very scarce south of 60°S, we have no reference to which to compare buoy reports from this region, and this is reflected in the SST map. The cold anomaly formerly west of the Antarctic Peninsula (65°S, 90°W) has disappeared due to no climatology available south of 60°S. The cold anomaly in the Weddell Sea region (60°S, 15°W) has been reduced somewhat in area. The warm anomaly east of Argentina (35°S, 50°W) has become warmer, with buoy 17653 reporting an anomaly 0.6° warmer than last time. The cold anomaly reported by buoy 14622 is 0.3° cooler as the buoy begins to move south. The warm anomaly at 40°S, 60°E has moved east, with buoy 17752 cooling 0.7° and buoys 14630 and 14639 warming an average of 1.3°. The warm anomaly south of Australia has linked to that east of New Zealand. This seems to be chiefly the result of buoys 56631 and 56639 warming an average of 1.3°. Also, buoy 56622 has warmed 0.7°. The warm anomaly east of New Zealand shows two extremes with cooler water between. The one extreme at 45°S, 180°W is the result of buoys 56605 and 17641 warming an average of 1.4°. The other extreme near 50°S, 140°W resulted from buoy 54640 reporting an anomaly 1.8° warmer than last time. A warm extreme has appeared east of South America at 30°S, 90°W, with a slight warming of the anomalies reported by buoys in the area.

APRIL 17-21/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: April 22 - 26, 1979

The number of reporting buoys is 170. The average sea surface temperature anomaly is 0.94°C. The warm anomaly east of New Zealand (50°S, 165°W) has returned to its previous oval shape. This is probably a consequence of buoy 56605 failing to report reliable temperature data. The extreme anomaly recorded by buoy 17641 has cooled 0.5°. The warm anomaly south of Australia (45°S, 135°E) has separated from the New Zealand anomaly again and has cooled slightly in its extreme. The warm anomaly in the Indian Ocean (40°S, 60°E) has warmed, with buoy 14639 recording an anomaly 2.3° warmer than last time. Other buoys nearby, 14630, 14644 and 17630, report anomalies almost as large. This anomaly has become much warmer and the centre has shifted east slightly. The cold anomaly reported by buoy 14622 south of Madagascar (30°S, 35°E) has persisted and has cooled 0.7° as the buoy moves south and east. The cold anomaly formerly in the Weddell Sea has shifted east to 55°S, 5°E as buoy 17621 on its western limit has warmed 0.7°. Finally, the warm anomaly off Argentina (35°S, 55°W) shows an extreme 0.8° warmer than last time at buoy 17653. The area covered by this anomaly has been reduced partly by the lower anomalies reported by buoys 17764 and 74616, on average 0.7° cooler.

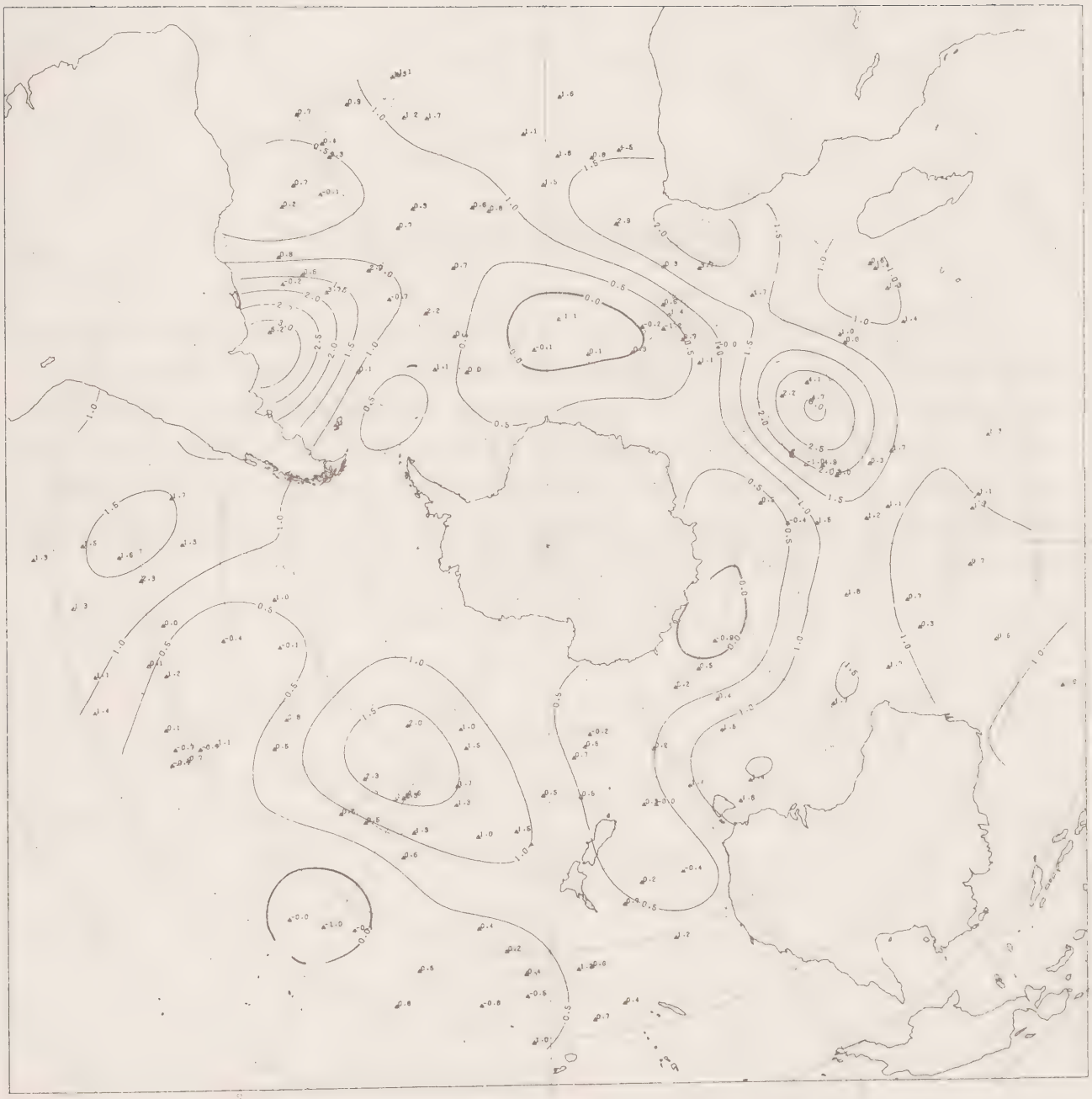


APRIL 22-28/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE. CANADA

SST Anomaly Map: April 27 - May 1, 1979

The number of buoys reporting is 167. The average sea surface temperature anomaly is 0.91°C. Since last time, the warm anomaly east of New Zealand (50°S, 150°W) has cooled. This is the result of a reduction in the anomalies reported by buoys on its western limb. A cold anomaly which has developed north of this anomaly (at 25°S, 150°W) and the absence of climatology south of this anomaly has caused the centre to be offset to the south of the peak anomalies recorded by buoy 54625. The warm anomaly south of Australia (formerly at 45°S, 135°E) has all but disappeared, primarily because buoy 56638 reports an anomaly 0.8° cooler than last time. The warm anomaly at 45°S, 60°E has reduced its coverage to the east but has linked to warm anomalies south of Africa. This has been possible because buoy 14622 ceased reporting with the subsequent disappearance of the cold anomaly near Madagascar. The warm anomaly east of Argentina has increased slightly in area, and the extreme reported by buoy 17653 is 0.3° warmer than last time.

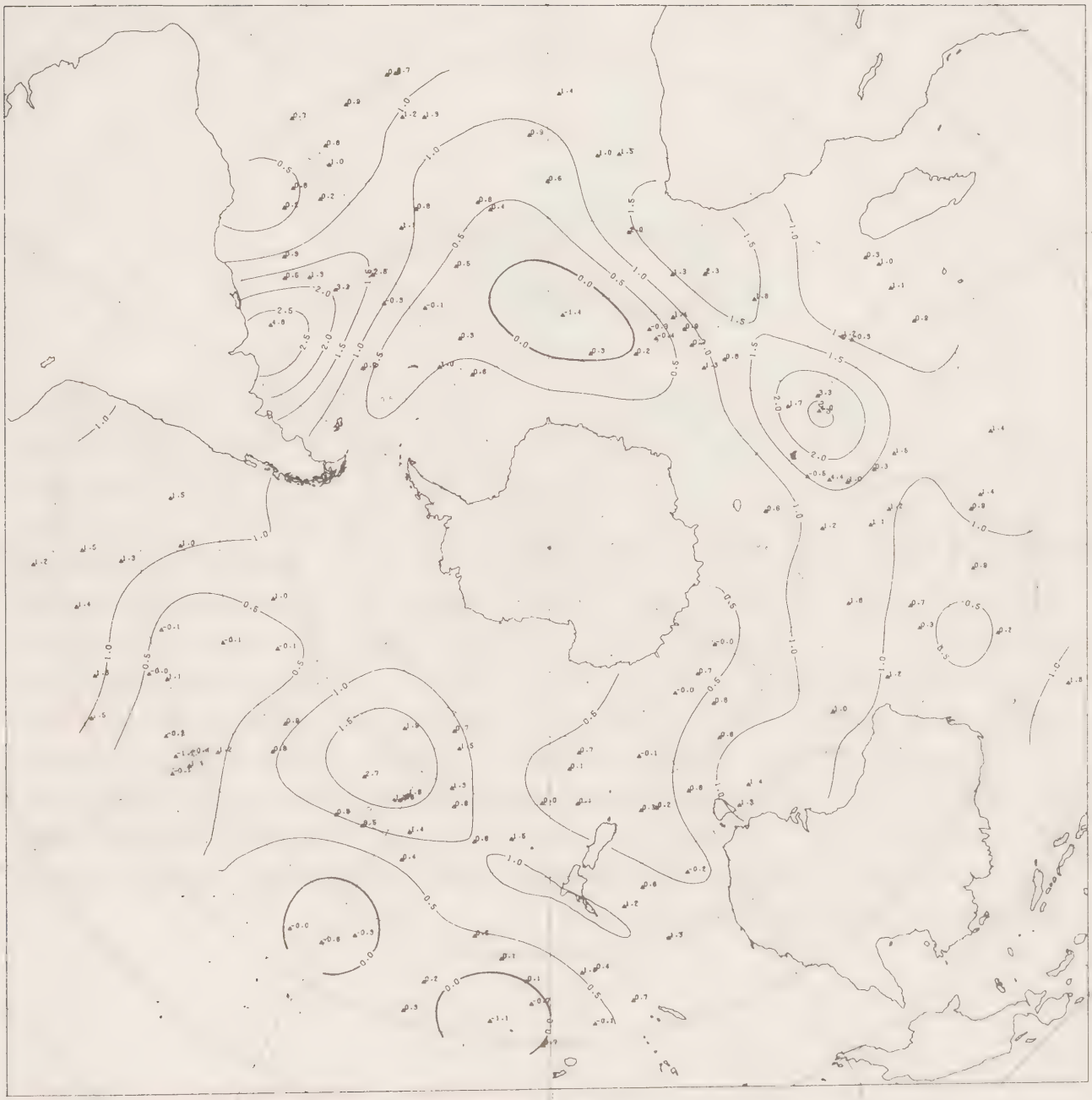


APRIL 27-MAY 1/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

SST Anomaly Map: May 2 - 6, 1979

The number of reporting buoys is 162. The average sea surface temperature anomaly is 0.85°C. A cold anomaly has appeared at 25°S, 170°W with buoys 17601 and 54616 reporting cold anomalies. The warm anomaly in the southwest Indian Ocean (45°S, 65°E) has cooled slightly, and the extreme reported by buoy 14630 is 0.5° cooler. The warm anomaly east of New Zealand (50°S, 150°W) and the cold anomaly at 55°S, 0°W are both stable in area and position. The warm anomaly east of Argentina (40°S, 55°W) reports an extreme by buoy 17653 which is 1.4° cooler than last time.



MAY 2-6/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: May 7 - 11, 1979

The number of reporting buoys is 169. The average sea surface temperature anomaly is 0.78°C. One of the largest changes since last time has been the development of the cold anomaly at 50°S, 0°W. Two new buoys, 17769 and 17770, report cold anomalies, with an extreme of -3.6°. This, combined with the drop in temperatures reported by buoys 17659, 74653 and 74629 on the eastern limits, has greatly extended the region influenced by this cold anomaly. The warm anomaly east of Argentina (45°S, 50°W) has cooled, with the extreme reported by buoy 17653 being 1.2° cooler than last time. The warm anomaly in the southern Indian Ocean (40°S, 70°E) has also cooled. The extreme anomaly reported by buoy 14639 is 0.9° cooler. The region from 90°E to 180°E at all latitudes shows about the same features as last time. The warm anomaly east of New Zealand (45°S, 140°W) has cooled, with the extreme reported at buoy 54625 being 0.6° cooler than before. The two cold anomalies formerly at 20°S, 170°W and 20°S,150°W have linked together, primarily because buoys 54629 and 54632 lying between the two centres report slightly cold anomalies this time.

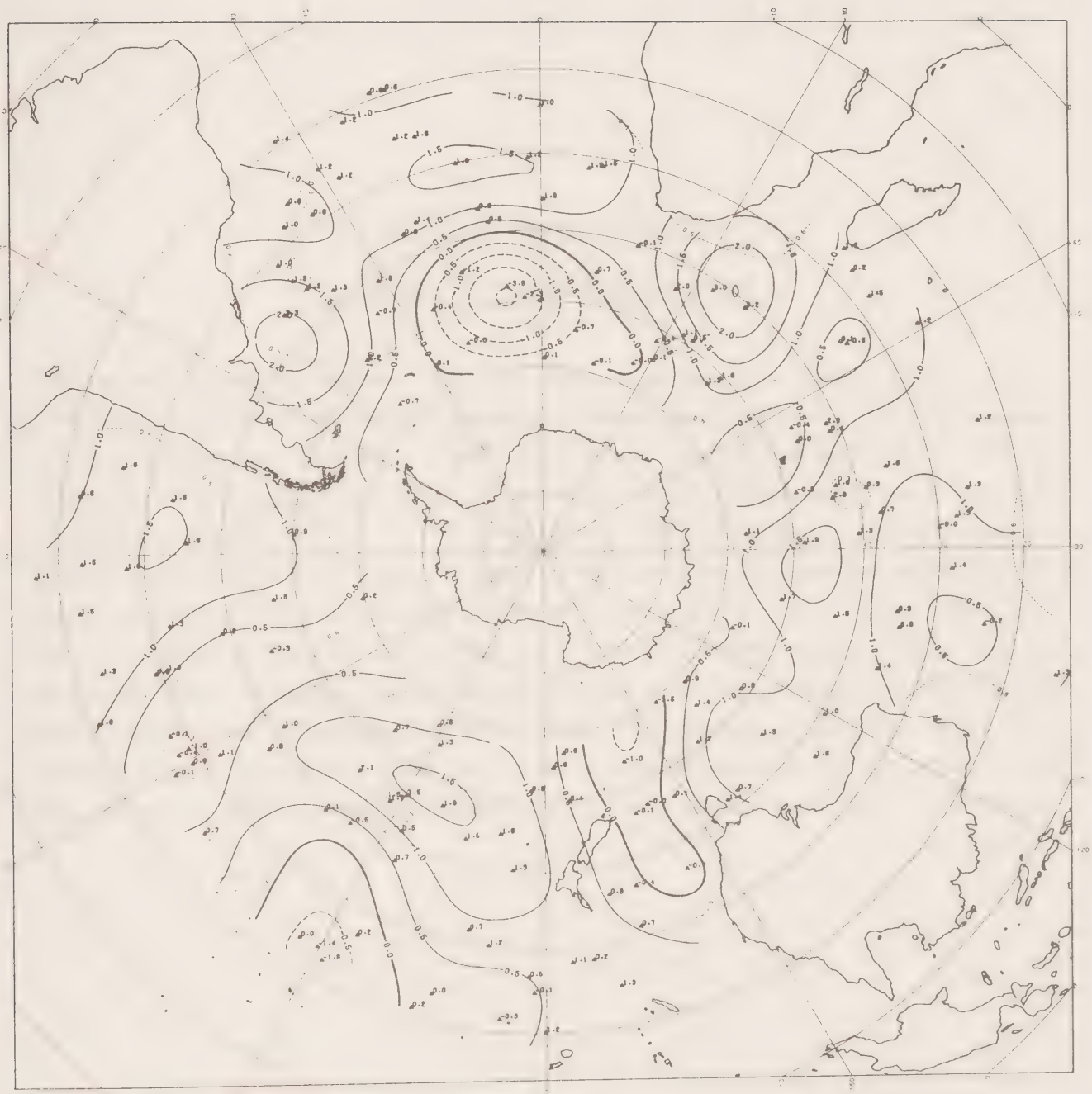
MAY 7-11/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: May 12 - 16, 1979

The number of reporting buoys is 178. The average sea surface temperature anomaly is 0.74°C. The cold anomaly at 50°S,0°W has persisted, with an extreme cold temperature of -3.8°C being reported by buoy number 17770. The warm anomaly east of Argentina (45°S,50°W) has not changed much since the last 5-day period. The anomaly south of Africa at 40°S,40°E has enlarged to the west, with buoys 74629 and 74653 now reporting warm anomalies of 3.0°C and 2.0°C respectively. The warm anomaly in the southern Indian Ocean (40°S,70°E) has collapsed, with buoy 14639 now reporting a warm anomaly of only 0.4°C. The region from 90°E to 180°W is once again rather static in character.



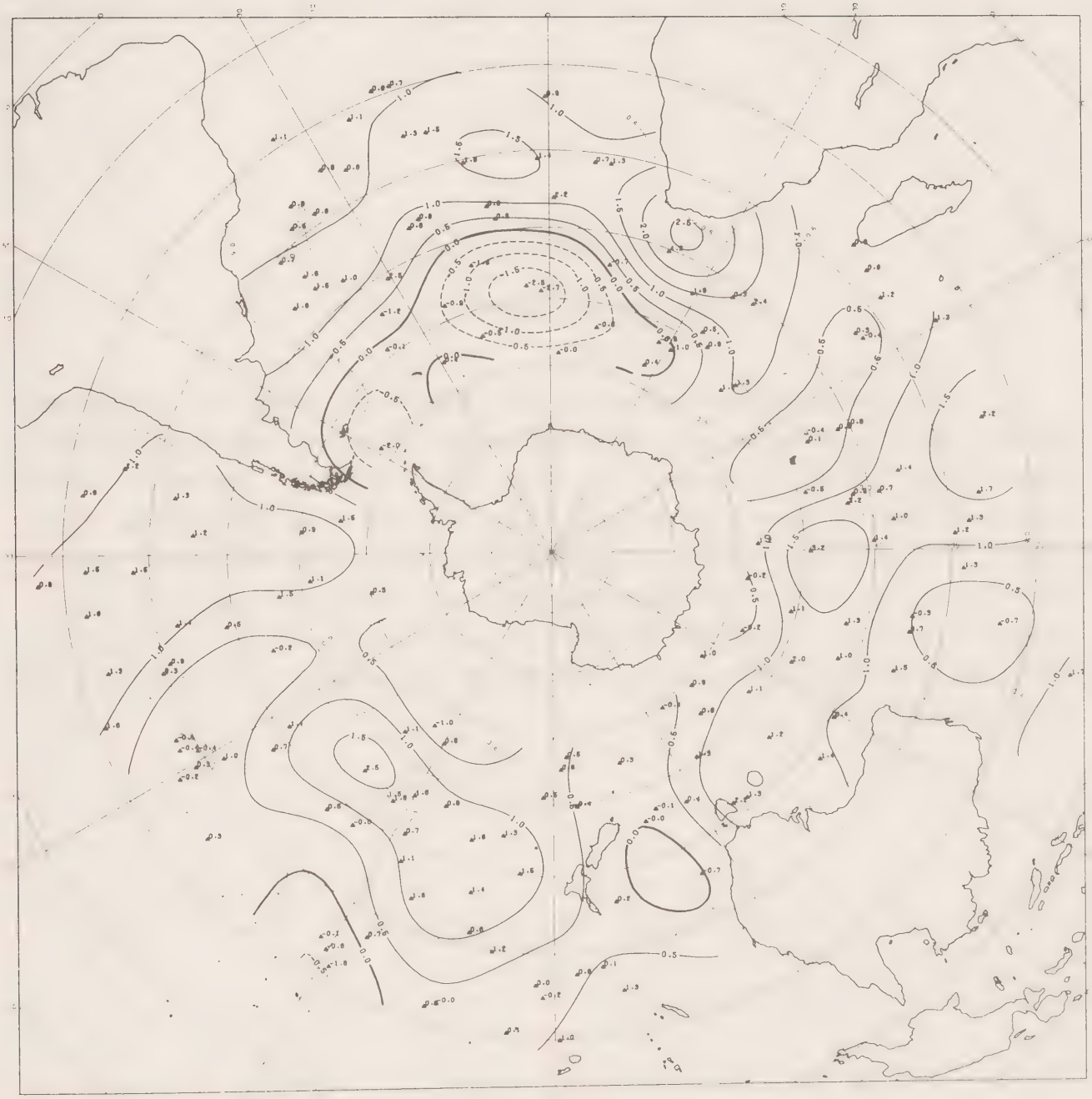
MAY 12-16/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: May 17 - 21, 1979

The number of buoys reporting is 183. The average sea surface temperature anomaly is 0.72°. Since last time, the warm anomaly southwest of Africa has moved west to 40°S, 20°E. This has occurred due to buoy 17659 reporting an anomaly 4.3° warmer than last time. Such a dramatic change must be considered doubtful for the moment. Coupled with this, buoy 74629 shows a cooling of 2.7°. The cold anomaly centered at 50°S, 0°W has extended its western limb to Drake Passage. This has occurred because buoy 54603 reports a 2.3° drop in anomaly as the buoy moved east and then north. There has also been a reduction from -3.8° to -2.7° in the extreme reported by buoys 17770 and 17769. The warm anomaly formerly east of Argentina has disappeared completely, with buoy 17653 reporting an anomaly 1.5° cooler. The cold anomaly between Australia and New Zealand has been severely reduced, because buoy 56617 now records a warm anomaly which is 1.3° warmer than last time. The anomaly reported by buoy 56626 has also warmed 1.1°.



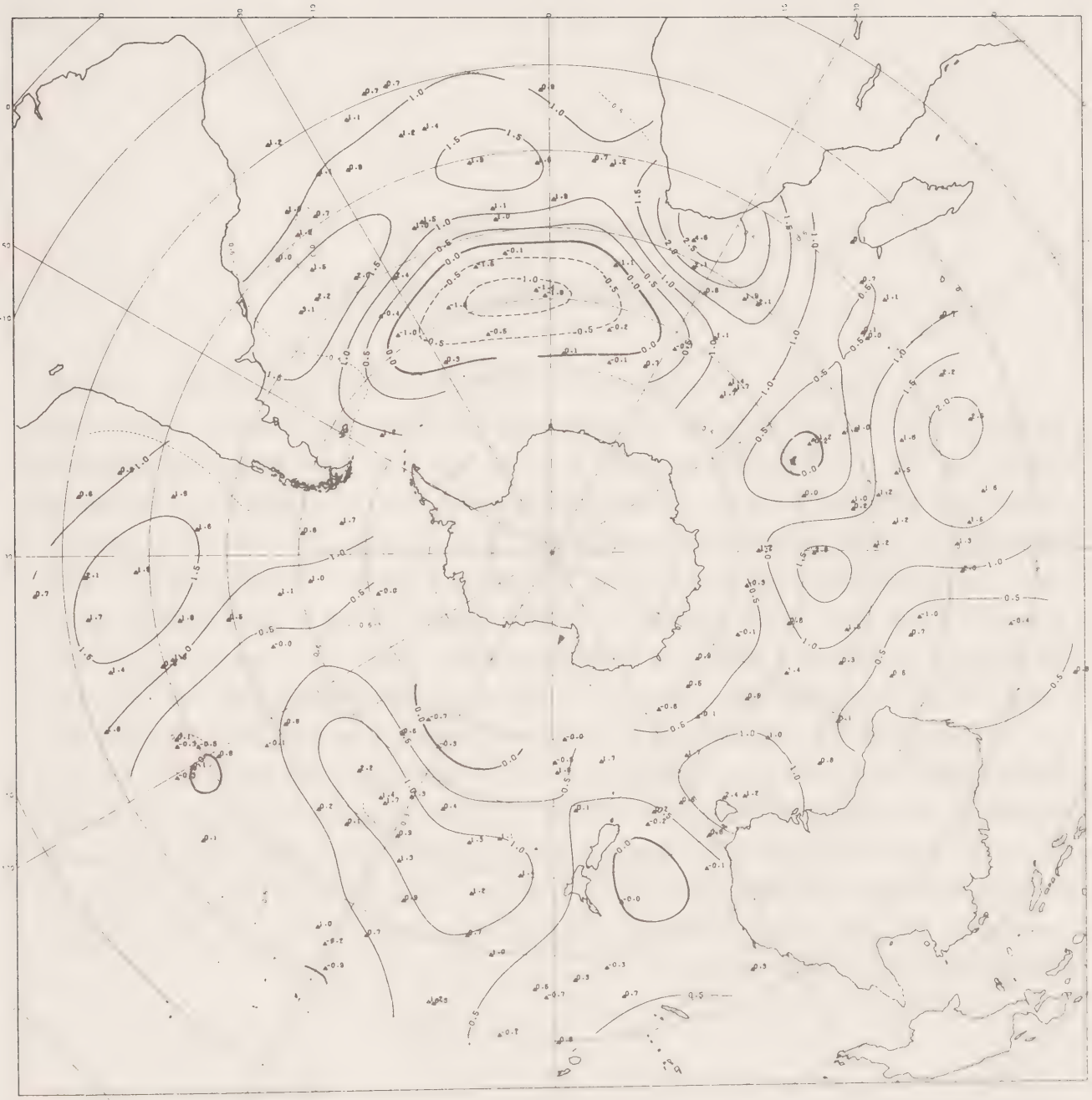
MAY 17-21/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: May 22 - 26, 1979

The number of reporting buoys is 188. The average sea surface temperature anomaly is 0.77°C. Since last time, the extreme value of the warm anomaly east of New Zealand (40°S, 150°W) has cooled 0.3°. Other buoys in the area also show a slight reduction. The cold anomaly formerly at 20°S, 150°W has all but disappeared. Buoy 17659 at 38°S, 25°E still reports a very warm anomaly of 4.5°. The cold anomaly centred at 50°S, 0°W has retreated from Drake Passage, with buoy 54661 now reporting a warm anomaly which is 3.2° warmer than last time. The warm anomaly east of Argentina (40°S, 50°W) has reappeared, because buoy 17653 reports an anomaly of 3.1°, which is 1.3° warmer than last time.



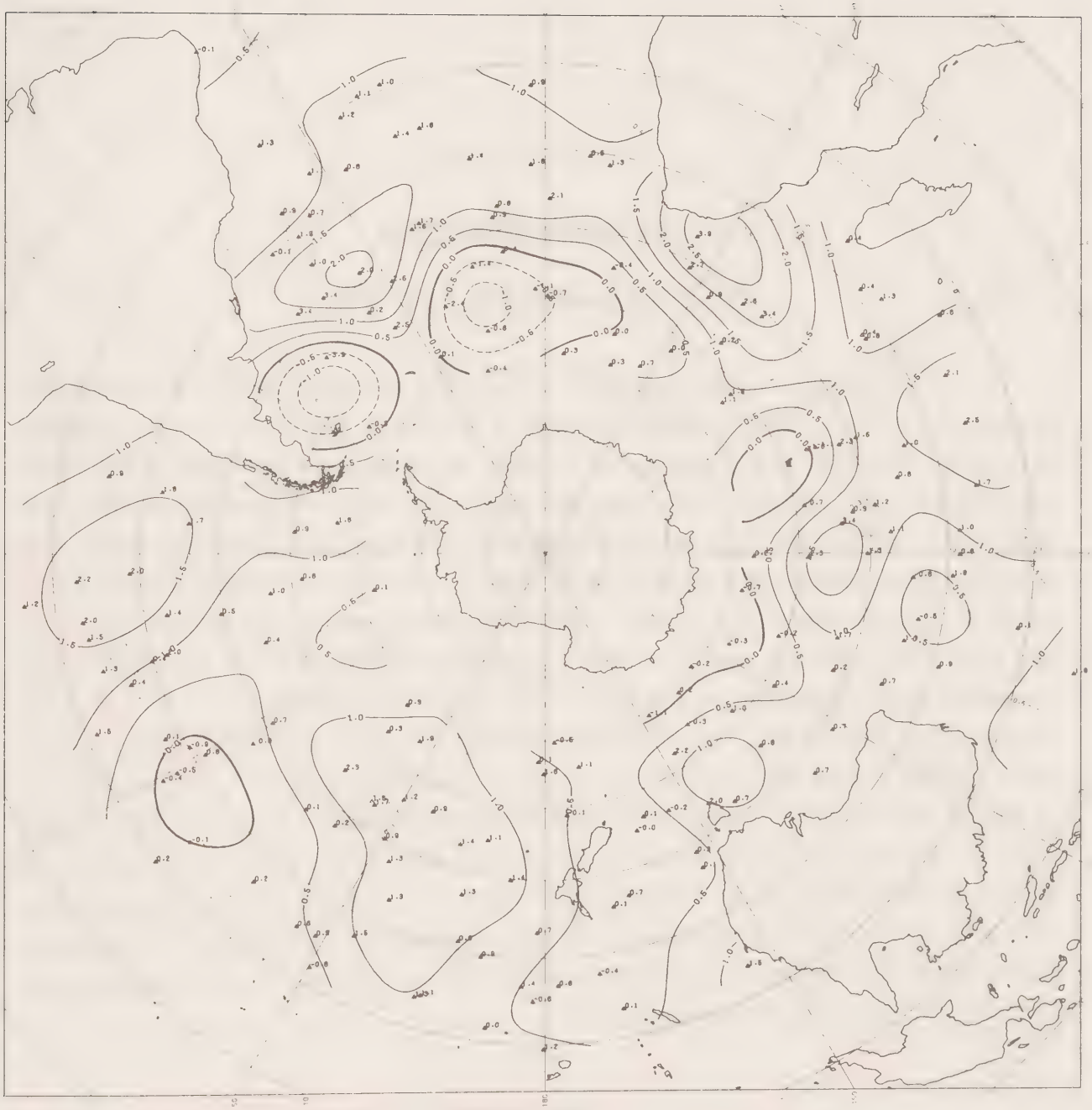
MAY 22-26/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: May 27 - 31, 1979

The number of reporting buoys is 194. The average sea surface temperature anomaly is 0.80°C. The most notable change has been the appearance of a cold anomaly reported by buoy 54643 at 45°S, 45°W. For the last 3 time periods, the temperature record reported by this buoy has contained spikes, looked too constant, and so was deleted. However, this time, although the temperature is around the same value as previously, there is some variation, making the record appear to be better. This buoy was included in the analysis this time. All of the structure of the feature east of Argentina (40°S, 150°W) has disappeared, leaving a large pool of generally warm water. The cold anomaly at 30°S, 150°W has grown larger. Only 1 more buoy reports a negative anomaly this time than last, but the average value has cooled 0.2°. The cold anomaly between Australia and New Zealand has disappeared, with all buoys in the area reporting warm anomalies. The cold anomaly in the south Indian Ocean (40°S, 60° - 120°E) has appeared because buoy 17629 has cooled 1.0° since last time. The warm anomaly east of Argentina has reappeared, although the centre appears displaced too far east. This is probably the result of the nearness of the cold anomaly of buoy 54643 and no dramatic changes in the anomalies reported by other buoys in the area.



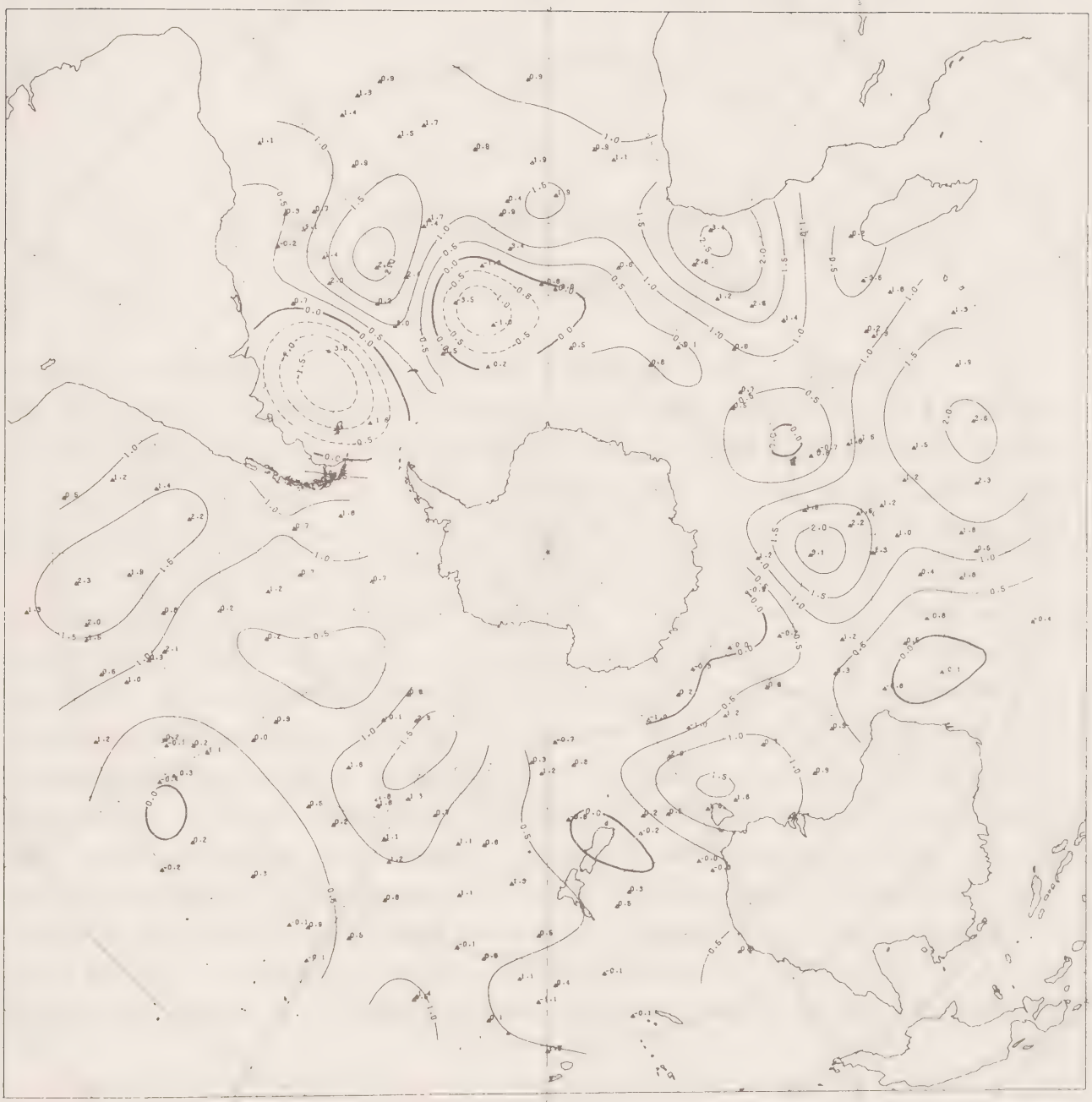
MAY 27-31/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: June 1 - 5, 1979

The number of reporting buoys is 193. The average sea surface temperature anomaly is 0.77°. The cold anomaly east of Argentina (45°S, 50°W) has expanded northward. This has been accomplished because the anomalies reported by buoys 17653 and 17623 are 2.7° and 2.0° cooler than last time. The centre of the warm anomaly just to the north and east (40°S, 30°W) has shifted east to be more centred on buoy 74617, now reporting the extreme warm anomaly in the area. The anomaly reported by buoy 17659 (40°S, 30°E) has cooled 0.5°, but other buoys from the area report values unchanged from last time. The two warm anomalies of the Indian Ocean (25°S, 75°E and 50°S, 90°E) have warmed slightly, with the latter showing the largest change. The areal extent of these anomalies has not changed. A cold anomaly has appeared at the south end of New Zealand (45°S, 165°E) largely because buoy 14620 reports an anomaly of -0.8°. The cold anomaly in the Pacific at 25°S, 125°W is diminished in size, as anomalies have generally warmed slightly. The warm anomaly formerly east of New Zealand has gone, to be replaced by another at 55°S, 150°W. It is centred on buoy 55608. A warm anomaly has developed near Tasmania (45°S, 145°E), with 3 buoys reporting anomalies greater than 1.8°. Finally, a cold anomaly has appeared west of Australia (30°S, 110°E), with 3 buoys reporting cold anomalies where before only one did (56608).



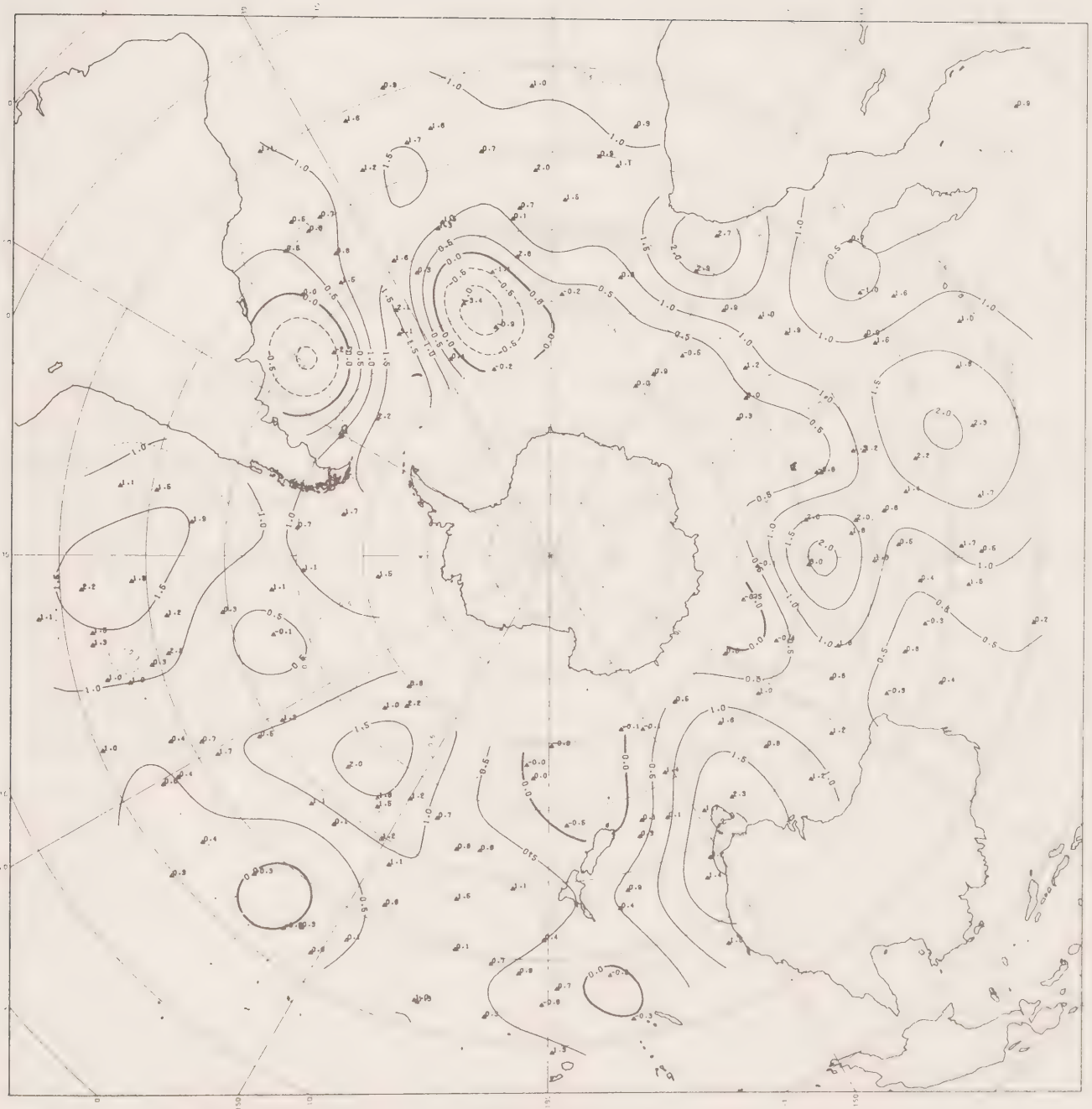
JUNE 1-5/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: June 6 - 10, 1979

The number of buoys reporting is 185. The average sea surface temperature anomaly is 0.85°. The cold anomaly east of Argentina (40°S, 50°W) has warmed, with the extreme reported by buoy 54643 being 1.1° warmer than last time. As well, buoy 54661 to the south has warmed 3.8° now to report a warm anomaly. The warm anomaly formerly at 40°S, 30°W has moved its center to the south to buoy 54603, where it is squeezed between 2 cold anomalies. The cold anomaly to the east at 50°S, 15°W is stable, with the extreme reported by buoy 17625 being only 0.1° warmer than before. The warm anomaly south of Africa (35°S, 25°E) has cooled, with the extreme now being reported by buoy 17771 and also 0.5° cooler than last time. The warm anomalies of the Indian Ocean (30°S, 75°E and 50°S, 90°E) are both stable in areal coverage. The warm anomaly near Tasmania (40°S, 150°E) has warmed further and expanded to encompass the ocean between New Zealand and Australia. The extreme anomaly is reported by buoy 17620 and is 3.2° warmer than last time. All buoys between New Zealand and Australia report warmer anomalies. The cold anomaly south of New Zealand (50°S, 165°E) has expanded to the south, with a strong cooling in the temperature recorded by nearly all the buoys in the area. Finally, the warm anomaly at 50°S, 140°W has expanded and the center moved north. This has been accomplished partly by the rise in anomalies reported by buoys on its eastern and northern sides.



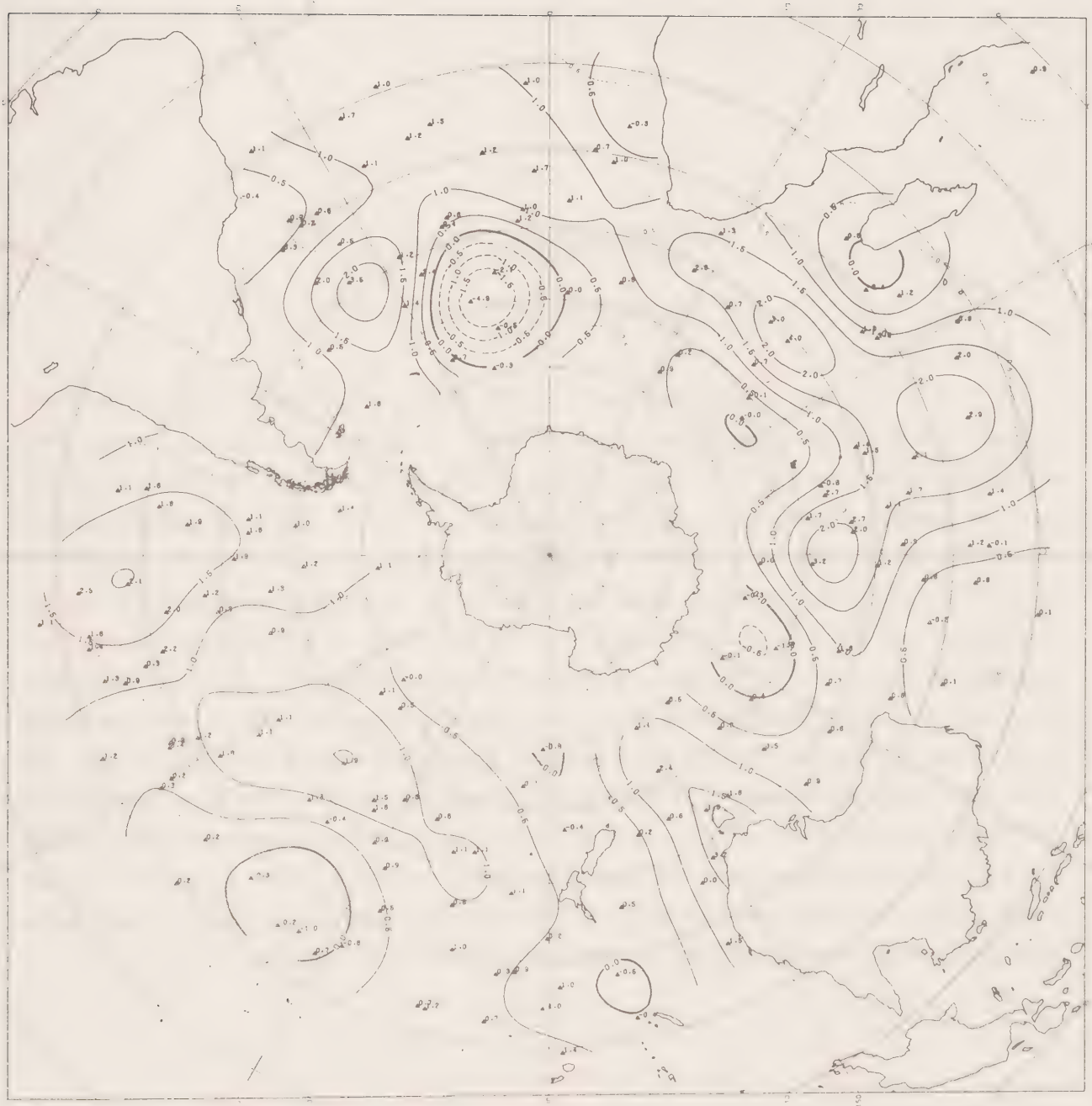
JUNE 6-10/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: June 11 - 15, 1979

The number of reporting buoys is 184. The average sea surface temperature anomaly is 0.87°. The most apparent change has been the disappearance of the cold anomaly formerly at 40°S, 50°W. The temperature anomaly now reported by buoy 54643 is 0.5°, some 3.2° warmer than last time. The cold anomaly just to the east reports even colder anomalies, with the extreme, again reported by buoy 17625, being 1.5° colder. The nearest buoy to 17625 is 2.8° warmer. The warm anomaly formerly at the tip of Africa has moved east to 40°S, 50°E, with buoys 74629 and 17752 reporting anomalies of 3.0° and 4.0° respectively. The two warm anomalies of the Indian Ocean, 30°S, 75°E and 45°S, 90°E, have both warmed and expanded in area. The cold anomaly south of Australia (55°S, 150°E) has cooled slightly and expanded in area. This is true also for the cold anomaly at 25°S, 145°W.



JUNE 11-15/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: June 16 - 20, 1979

The number of reporting buoys is 189. The average sea surface temperature anomaly is 0.88°. The warm anomaly at 45°S, 35°W is starting to weaken. The extreme, reported by buoy 17657, is 0.5° cooler than last time, while buoy 17623, around which the anomaly formerly was centred, reports an anomaly 1.4° cooler. The cold anomaly just to the east at 50°S, 15°W has weakened slightly as well, with the extreme, still reported by buoy 17625, being 1.1° warmer than last time. The small cold anomaly just east of Madagascar has become much stronger still as the result of a cold anomaly of -5.2° reported by buoy 14621. The other buoys in the area report fairly constant anomalies from last time. The strengthening of this cold anomaly has separated the warm anomaly at 40°S, 30°E from the other two in the Indian Ocean (25°S, 75°E and 45°S, 90°E). All three anomalies are cooler, with the largest change occurring at the first, where buoy 17752 reports an anomaly 2.9° cooler. The cold anomaly east of Australia (25°S, 170°E) has expanded in area, probably because buoy 54623 reports a cooler anomaly than last time. Finally, the warm anomaly at 35°S, 90°W has developed two extremes around buoys 17651 and 17664. Anomalies from this whole region have increased slightly.

JUNE 16-20/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

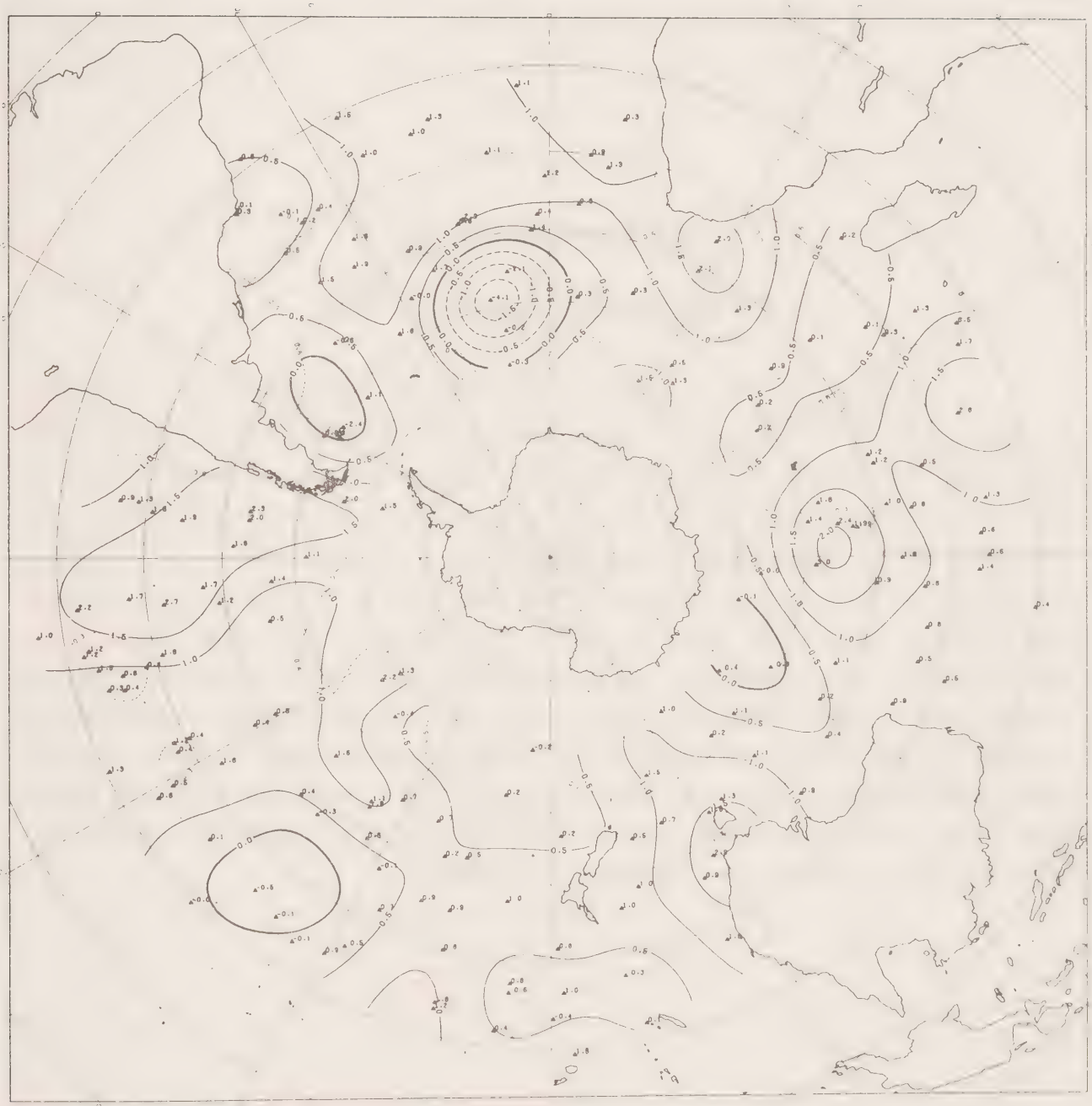
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: June 21 - 25, 1979

The number of buoys reporting is 190. The average sea surface temperature anomaly is 0.81°. Two buoys show very large anomalies. One is buoy 14621 (25°S, 50°E) with an anomaly of -7.4°, and the other is buoy 74629 (40°S, 50°E) with an anomaly of 6.3°. Both temperature records appear to be reasonable, apart from dramatic but steady trends. Both of these anomalies are so large and have no near neighbours which support these values that they have been eliminated from the SST anomaly map. It was considered easier to imagine the anomaly field with these buoys in than the opposite.

Since last time, the cold anomaly at 50°S, 15°W has cooled slightly in its extreme, reported by buoy 17625. A cold anomaly has developed east of Argentina at 50°S, 60°W with a new buoy, 17622, reporting a cold anomaly of -2.4°. The buoy appears to be grounded on the Falkland Islands, so that the reported anomaly must be considered suspect for the moment. The warm anomaly south of Africa (40°S, 30°W) has cooled, with the extreme, reported by buoy 17771, being 0.9° cooler than before. The distribution of buoys near the warm anomaly in the Indian Ocean (peaks at 25°S, 75°E and 45°S, 90°E) has changed slightly, and this seems to be responsible for the altered contours in this region; the reported anomalies are virtually unchanged from last time. The cold anomaly at 55°S, 120°E has warmed, with the extreme, reported by buoy 54567, being 0.9° warmer. The warm anomaly near Tasmania has altered in the south due to buoy 56638 reporting an anomaly 1.4° cooler than last time. The cold anomaly north of New Zealand (25°S, 175°E) has disappeared, with the buoys reporting slightly warmer anomalies than last time.



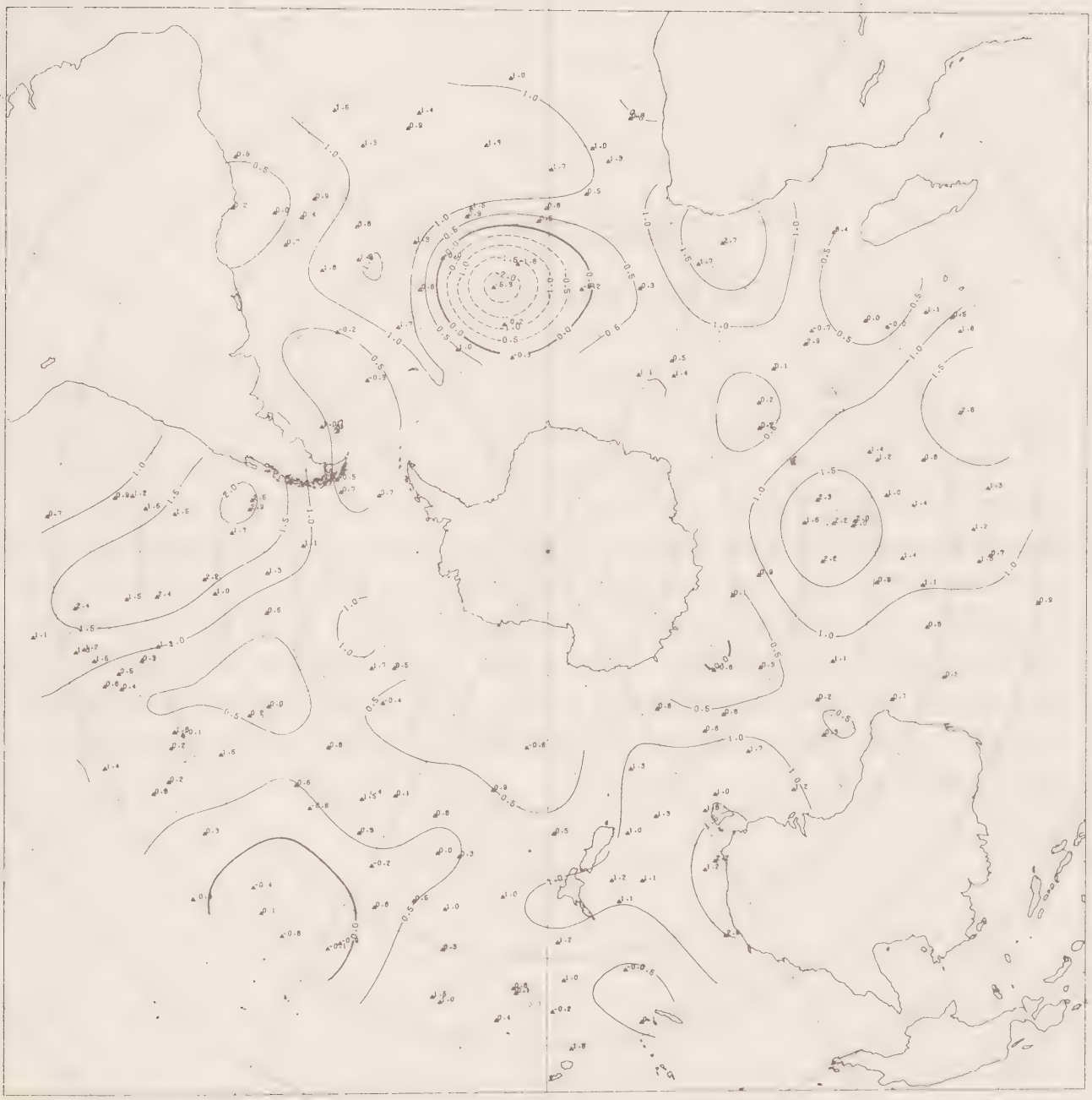
JUNE 21-25/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: June 26 - 30, 1979

The number of reporting buoys is 189. The average sea surface temperature anomaly is 0.83°C. The cold anomaly at 50°S, 10°W has cooled in the extreme value, reported by buoy 17625. Other buoys in the neighbourhood report slight changes in anomalies since last time. The warm anomalies in the Indian Ocean (25°S, 75°E and 45°S, 90°E) have cooled slightly, in particular the extreme to the south. Buoys in the eastern limb of this anomaly seem to have all warmed slightly. The extreme anomaly reported near Tasmania (buoy 17620) has cooled 0.7° since last time, while other buoys report constant anomalies. The cold anomaly of the Pacific (25°S, 145°W) has expanded with a slightly cooler extreme reported by buoy 56606. The cold anomaly, the consequence of the report from buoy 17662 near the Falkland Islands, has disappeared. This buoy failed to report a reliable temperature this time. One of the buoys, 74629, which reported such a large positive anomaly last time, now reports an anomaly of 2.9°, some 3.4° cooler. The other buoy, 14621, failed to report reliable temperatures.



JUNE26-30/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 3 - 5, 1979

The number of reporting buoys is 186. The average sea surface temperature anomaly is 0.74°. The cold anomaly in the Atlantic (50°S, 10°W) has decreased in area. The extreme anomaly, reported by buoy 17625, is 0.8° warmer. Also, the anomaly reported by buoy 17608 is 1.2° warmer. A cold anomaly has developed south of Madagascar again. This time, 4 buoys report cold anomalies. The warm anomaly south of Africa (45°S, 30°E) has become warmer, with the extreme reported by buoy 17659 being 0.9° warmer than last time. Buoy 17755 to the west reports an anomaly 2.9° warmer. The double-lobed warm anomaly in the Indian Ocean, at 40°S, 90°E, has all but disappeared. The cold anomaly formerly at 25°S, 145°W has also vanished, to be replaced by a cold anomaly north of New Zealand. Four buoys in the area report cold anomalies, 3 being colder than -1°.

JULY 3-5/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

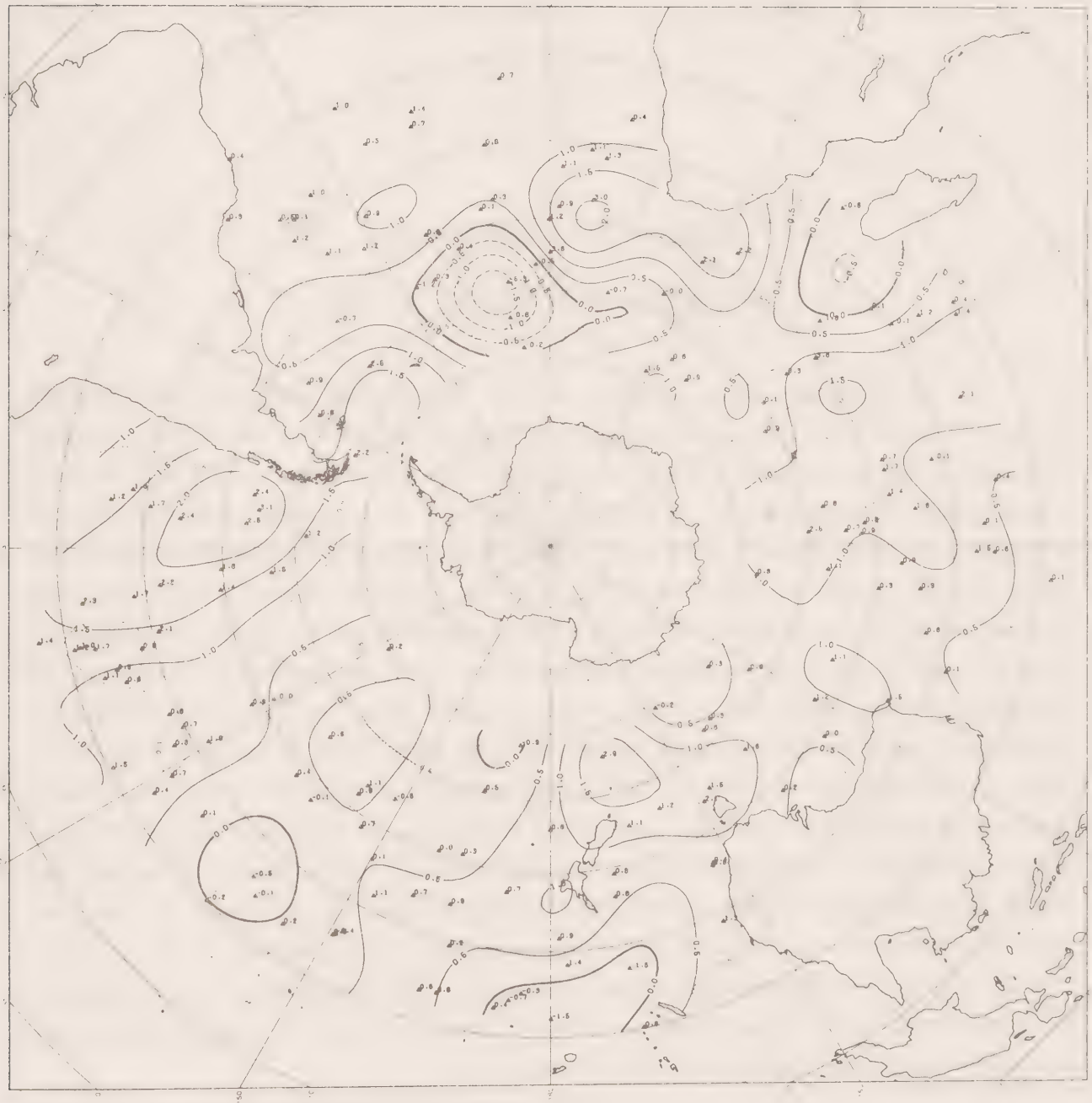
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 6 - 10, 1979

The number of reporting buoys is 180. The average sea surface temperature anomaly is 0.77°. The products put out for the last time period all bear the date July 3 - 5, 1979. This is because for the first 2 days of July, the positions received for every buoy were in error and we were not able to correct them. Consequently, the data for this time period has not been displayed.

Although the anomaly reported by buoy 17625 in the Atlantic (50°S, 15°W) is 0.9° cooler than last time, the associated feature is shifted west of being centred on this buoy. The reason for this seems to be the warm anomaly reported by buoy 17772 near 45°S, 0°W. Otherwise, this cold anomaly shows little change since last time. The warm anomaly south of Africa (45°S, 0° - 15°E) has cooled in the eastern limit with buoy 17659 reporting an anomaly 1.4° cooler. The western limb remains stable. The cold anomaly near Madagascar (30°S, 45°E) is also stable, although only 3 buoys in the area report negative anomalies. A warm anomaly has developed south of New Zealand (50°S, 165°E) centred on buoy 56638. This buoy reports an anomaly 0.9° warmer than last time. The cold anomaly north of New Zealand (25°S, 180°W) has opened to the north with buoy 17607 (near 20°S, 180°W) not reporting a temperature this time. A cold anomaly has formed near 25°S, 135°W with 3 buoys in the area reporting slightly cold anomalies. The warm anomaly west of Chile (40°S, 90°W) has warmed further. Extreme values have not changed much, but there has been a general warming in the whole area.



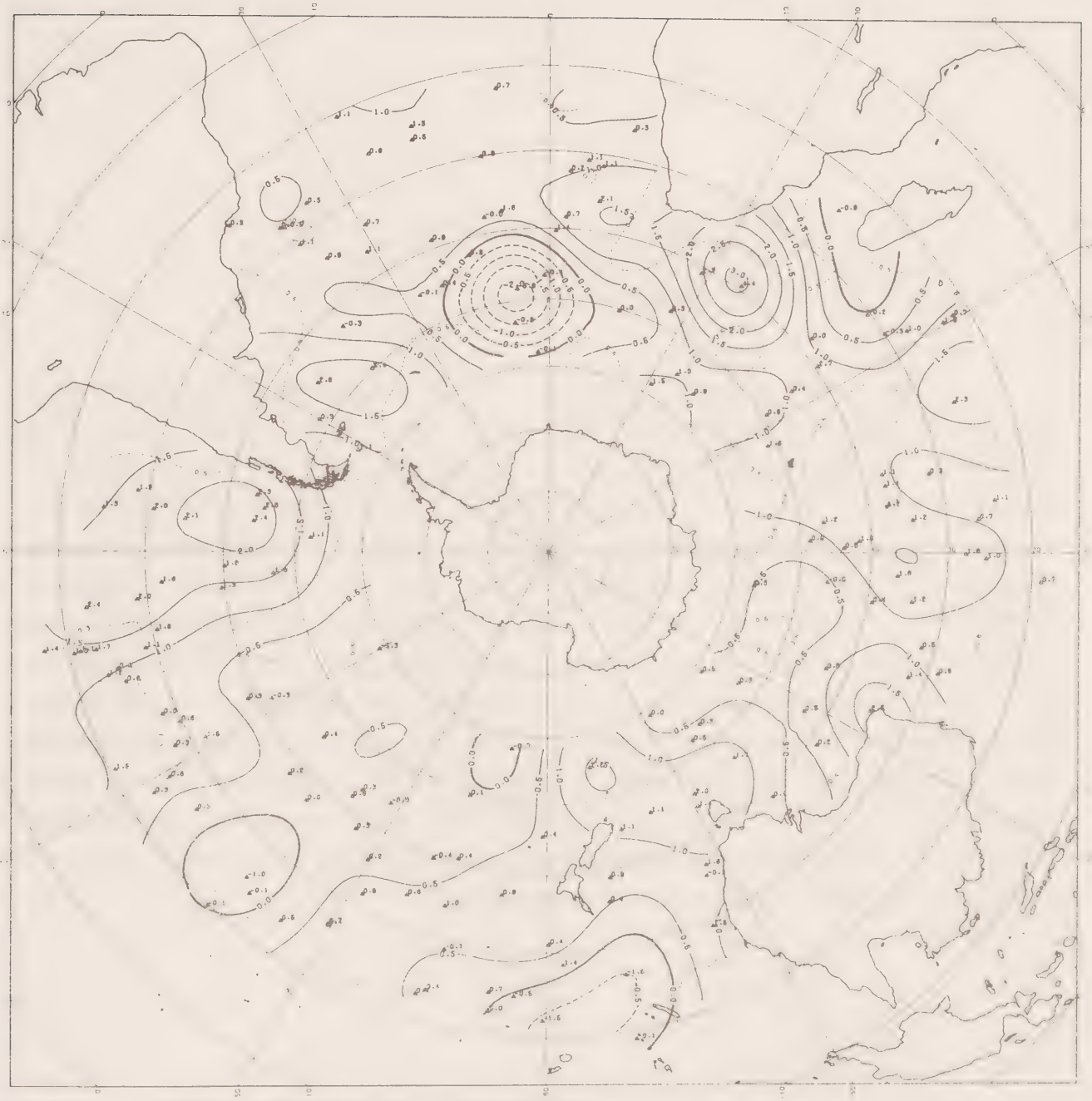
JULY 6-10/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 11 - 15, 1979

The number of reporting buoys is 178. The average sea surface temperature anomaly is 0.79°. The warm anomaly south of Africa (40°S, 35°E) has become stronger with buoy 17659 reporting an anomaly of 4.4, some 2.2° warmer than last time. The cold anomaly near Madagascar, 30°S, 45°E, persists with 3 buoys reporting slightly cold anomalies. A warm anomaly seems to be developing off the southwest tip of Australia (35°S, 120°E) because of an anomaly of 2.5° being reporting by buoy 17619. The cold anomaly north of New Zealand (20°S, 170°E) has become larger in extent. The reason for this expansion is not clear, since most of the buoys in the region report almost identical anomalies to last time. The warm anomaly south of New Zealand (55°S, 165°E) has diminished in area with the extreme reported by buoy 56638 being 0.7° cooler than before. Both the cold anomaly at 25°S, 135°W and the warm anomaly at 40°S, 90°W are stable. The cold anomaly at 50°S, 5°W has regained its former shape with buoy 17625 reporting an anomaly of -5.8°. The anomaly at this position first formed in late April and has persisted since. From the first of June, the reported anomaly has been greater than -3°. We have chosen to continue to include this report from buoy 17625 firstly because as far as we can tell the temperature reports are reliable; and secondly, the historic data from this part of the ocean in this time of year is sparse, and what there is appears to indicate rather large standard deviations away from the mean temperature.



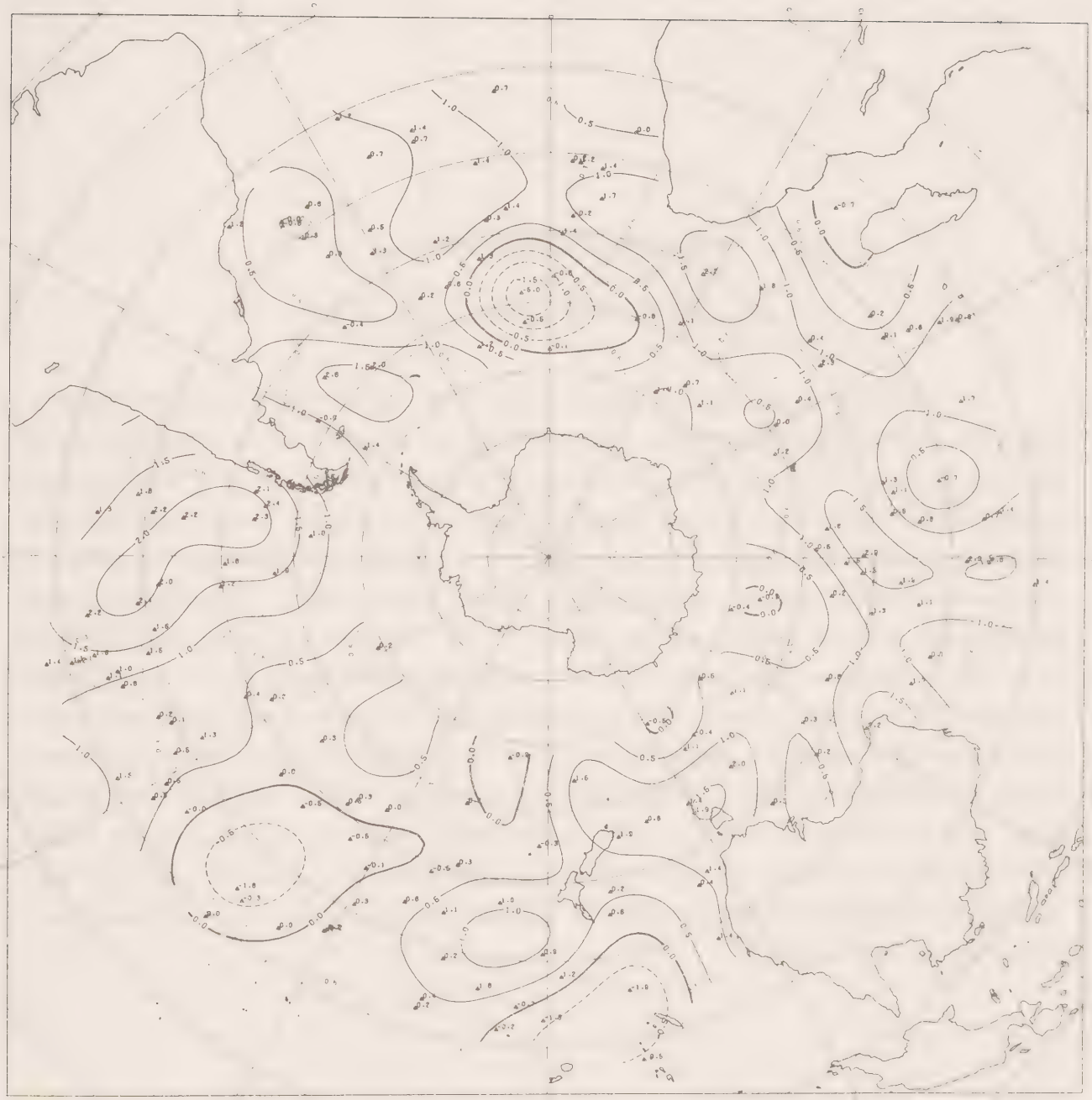
JULY 11-15/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 16 - 20, 1979

The number of reporting buoys is 178. The average sea surface temperature anomaly is 0.74°C. The warm anomaly reported by buoy 17659 southeast of Africa (40°S, 30°E) is 2.2° cooler than last time, with the subsequent diminution of the size of the feature centred on this buoy. The cold anomaly near Madagascar (25°S, 40°E) has retreated to the north. Now only one buoy, 14627, reports a cold anomaly. The warm anomaly which was centred south of New Zealand on buoy 56638 has shifted to Tasmania (45°S, 150°E) to centre near buoy 56632. The cold anomaly north of New Zealand (25°S, 170°E) is stable, although the extreme, reported by buoy 56610, is 0.3° colder than last time. Five buoys in the area report cold anomalies. The cold anomaly in the central Pacific (30°S, 135°W) has expanded greatly. This is due to cold anomalies being reported west of its former area by buoys 14615, 56606 and 54627. As well, the extreme value, reported by buoy 17675, is 0.8° colder than last time. The warm anomaly west of Chile (40°S, 90°W) has expanded the area enclosed by the 2.0° contour to the north. There are presently 8 buoys reporting anomalies warmer than 2.0°.



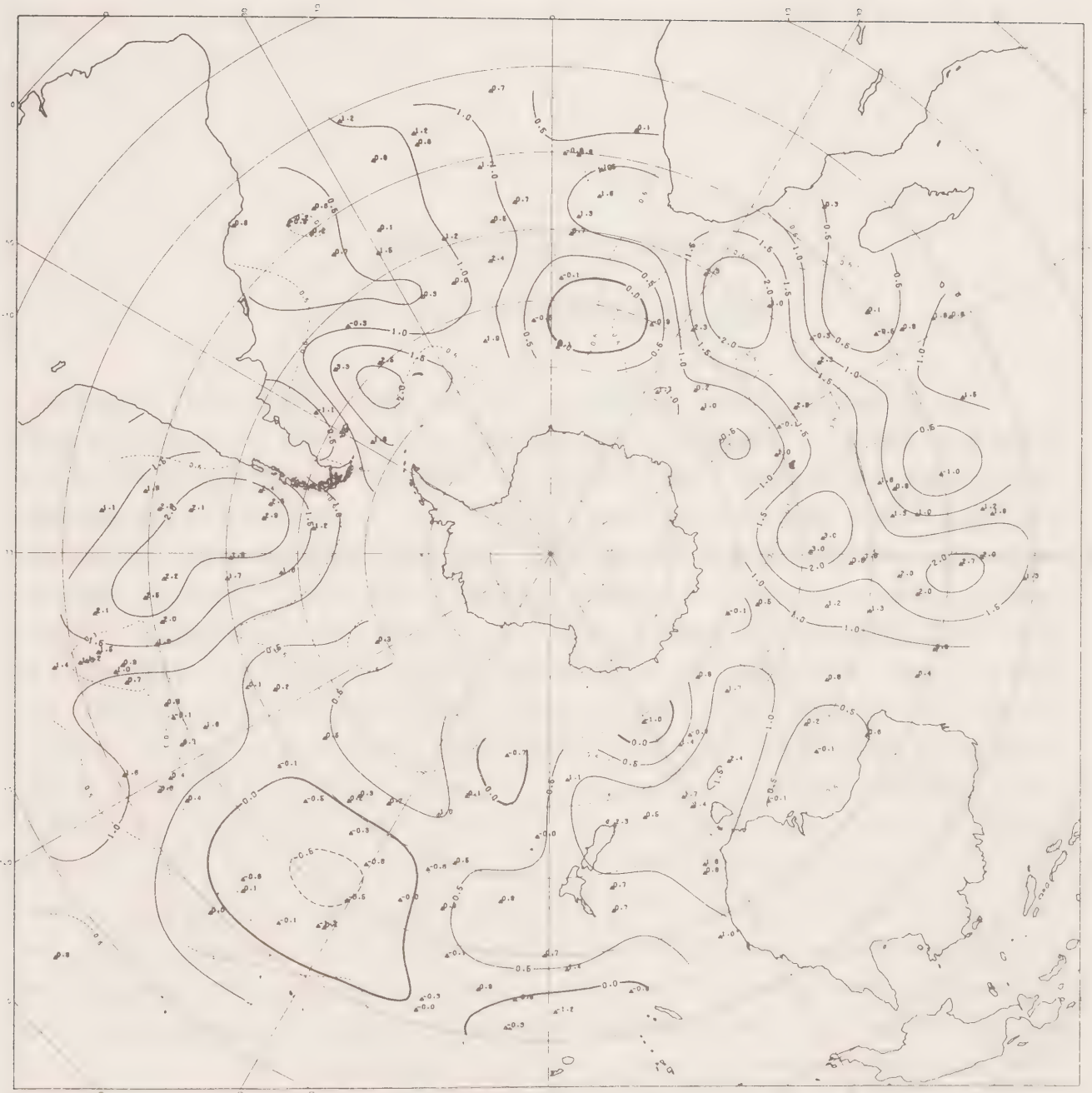
JULY 16-20/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 21 - 25, 1979

The number of reporting buoys is 176. The average sea surface temperature anomaly is 0.85°. The largest change since last time has been the virtual disappearance of the cold anomaly in the Atlantic Ocean (formerly at 50°N, 10°W). This has happened because buoy 17625, which has been reporting very cold anomalies, failed to report. The remaining buoys in the area report anomalies which are about the same as last time. A triple-peaked warm anomaly has developed in the Indian Ocean. The linking of the extremes was accomplished by a 2.4° increase in the anomaly reported by buoy 16609 at 45°S, 60°E. There has also been warmer anomalies reported by buoys near 50°S, 90°E and 30°S, 90°E. The cold anomaly near Madagascar has disappeared with buoy 14627 now reporting a warm anomaly. The cold anomaly at 20°S, 180°W has retreated to the north. This has been caused by the anomaly reported by buoy 56610 being 1.3° warmer than last time. The cold anomaly at 30°S, 145°W has expanded to the west because buoys 54662, 56641, 54629, 54632, 54634 and 17674 now report cold anomalies. The warm anomaly west of Chile (40°S, 90°W) has expanded slightly with an average anomaly over 10 buoys being 0.02° warmer than last time.



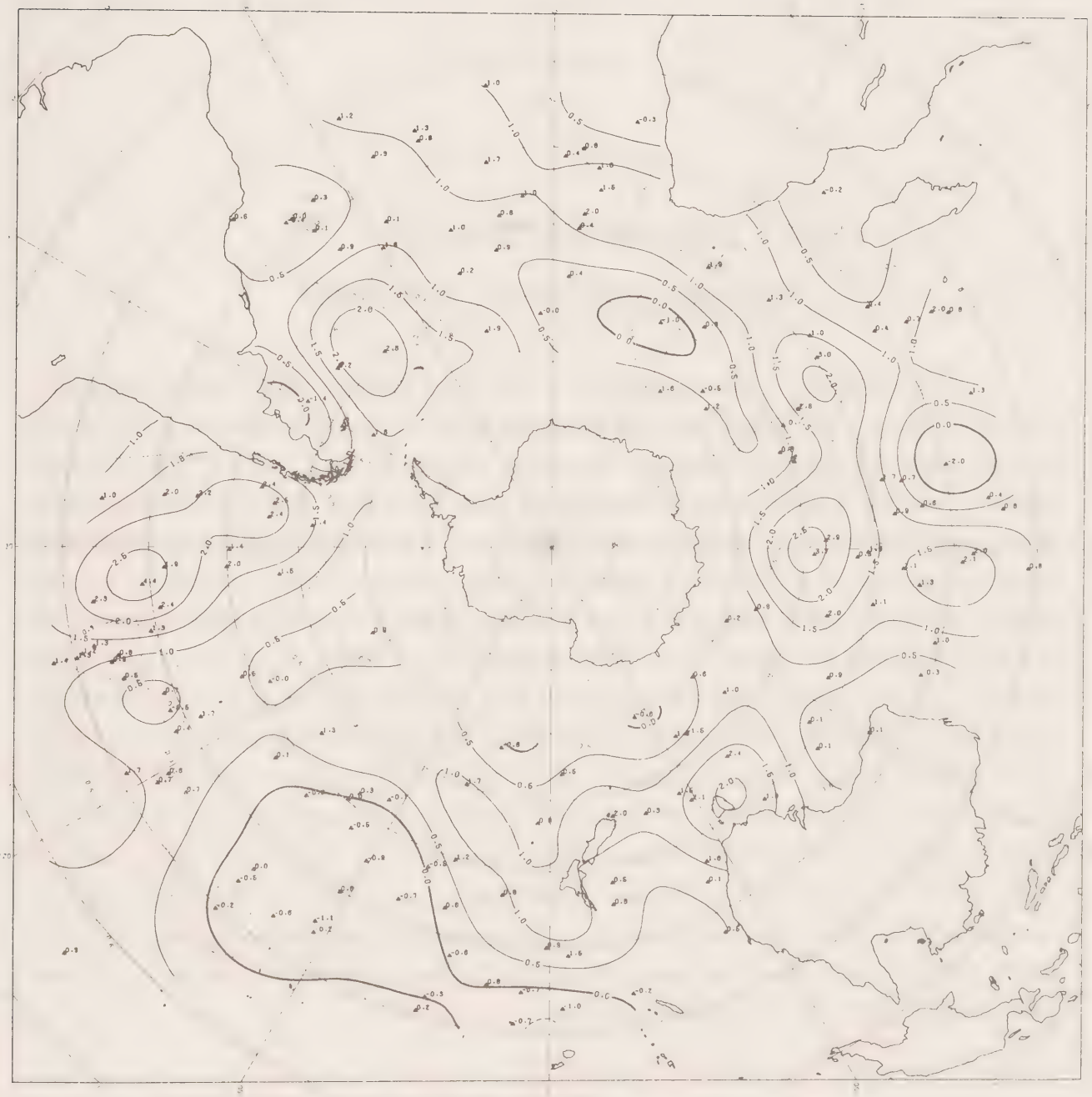
JULY 21-25/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 26 - 30, 1979

The number of reporting buoys is 172. The average sea surface temperature anomaly is 0.83°C. A startling change since last time has been the increase in area enclosing the cold anomaly in the Pacific (30°S, 150°W). This appears to have been accomplished by cooler anomalies being reported by buoys 17674 and 54634. The anomaly reported by buoy 54662 (30°S, 150°W) is not consistent with those in the surrounding areas. The warm anomaly centred near Tasmania (40°S, 145°E) has become warmer. Buoys 56632 and 17626 both report warmer anomalies, with the latter being 2.0° warmer than last time. On the southern fringe of this feature, buoys 54664 and 54658 report a temperature difference of 3.3° over a distance of about 100 km. A cold anomaly has developed in the Indian Ocean, centred on buoy 14646. The anomaly reported by this buoy has been steadily getting colder from June 26. The warm anomaly at 50°S, 90°E is also warmer, with the extreme reported by buoy 14651 being 0.7° warmer than last time. The cold anomaly formerly at 50°S, 10°E has migrated to 50°S, 25°E to centre on buoy 17769. The warm anomaly off Argentina (50°S, 45°W) has expanded in area probably because buoy 54643 to the north, which reported a cold anomaly last time, failed to report. Finally, the warm anomaly west of Chile (30°S, 95°W) has warmed primarily due to a change of 1.9° reported by buoy 17651. The temperature reported by this buoy has risen steadily over the five days, and there is some suspicion that the buoy is beginning to fail.



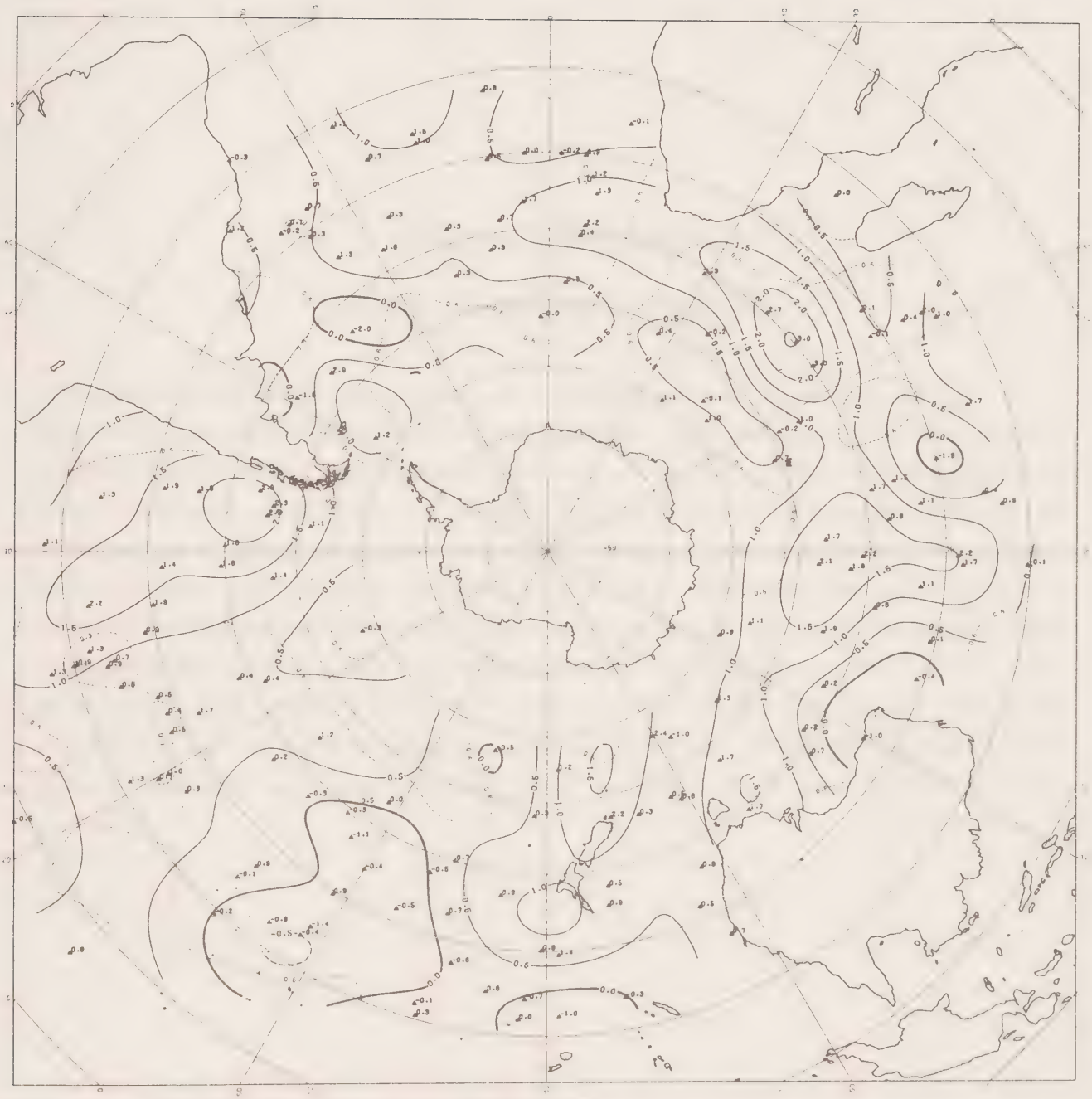
JULY 26-30/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: July 31 - August 4, 1979

The number of reporting buoys is 170. The average sea surface temperature anomaly is 0.73°. The warm anomaly which was situated east of Argentina (50°S, 40°W) has been replaced by a cold anomaly. The reason for this is that buoy 54643 did not report last time, but this time reported an anomaly of -2.0°, while buoy 54661, which reported an anomaly of 2.5° last time, failed to report this time. The cold anomaly formerly at 50°S, 25°E has disappeared with buoy 17769 now reporting a warm anomaly. The warm anomaly at 40°S, 50°E now shows three buoys with anomalies greater than 2.6°, where before there was only one. The two warm anomalies at 50°S, 90°E and 30°S, 95°E have coalesced and cooled, with the extreme anomaly now being 2.2°. A cold anomaly has appeared off the southwest of Australia (35°S, 120°E). This is due to buoy 17619 reporting an anomaly of -1.0°. This buoy does not appear to have moved for the last five days. The warm anomaly formerly near Tasmania (45°S, 150°E) has all but disappeared with buoys 54663, 17626 and 56632 showing an average 0.8° drop in their reported anomalies. The cold anomaly at 30°S, 150°W has split off the western portion again. Anomalies in the whole area are consistent with those reported last time. The extreme of the warm anomaly off Chile (40°S, 85°W), which last time was 4.4° reported by buoy 17651, is in the south at buoy 17609. Buoy 17651 failed to report this time.



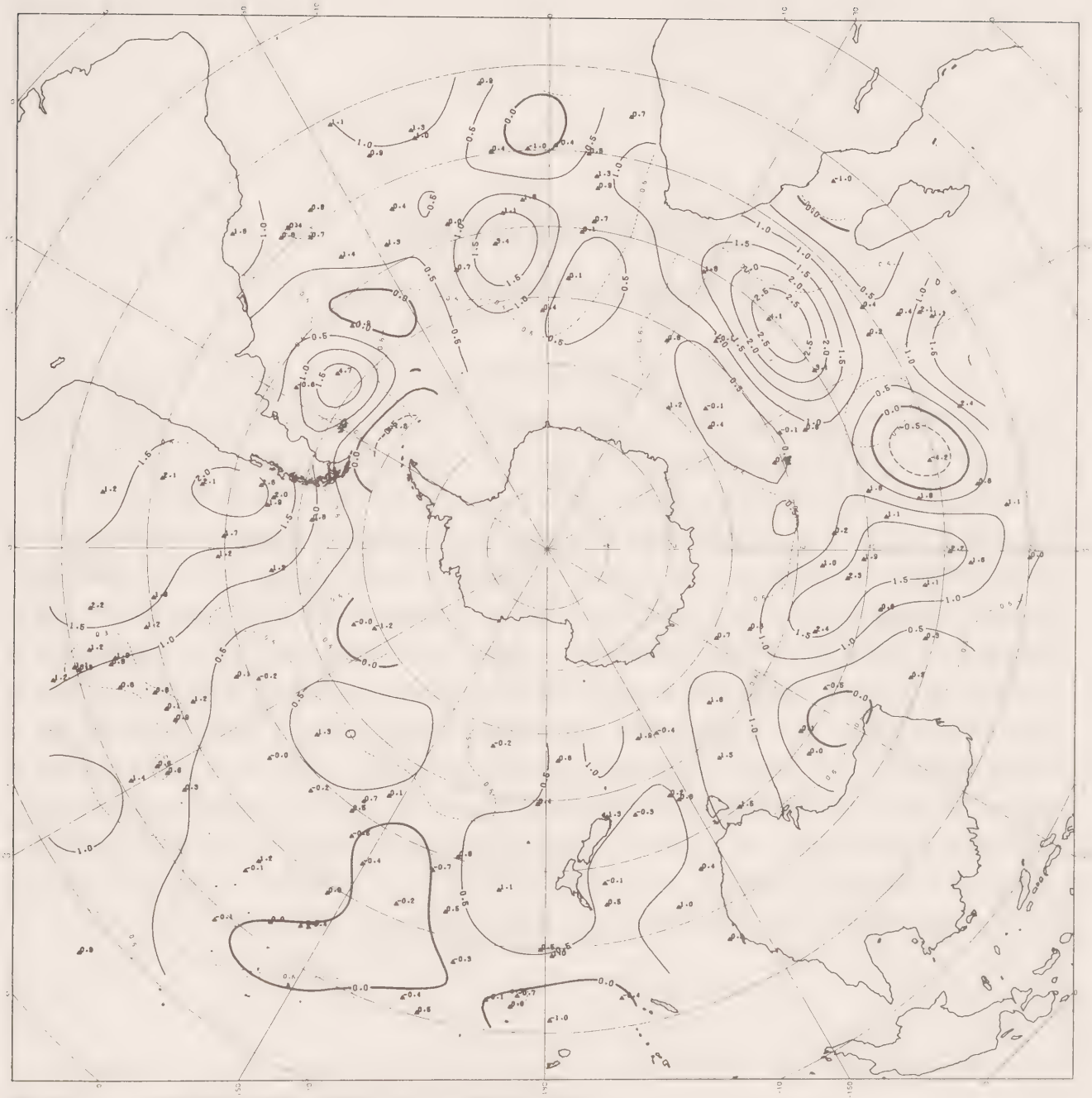
JULY 31 - AUG 4/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: August 5 - 9, 1979

The number of reporting buoys is 163. The average sea surface temperature anomaly is 0.71°. Since last time, a strong positive anomaly has developed centred on buoy 17662 at 47°S, 50°W. This is the only buoy in the area recording a warm anomaly. The anomaly recorded by buoy 17657 (42°S, 10°W) is 2.5° warmer than last time. Other buoys in the area show increases as well. The warm anomaly southeast of Africa (40°S, 45°E) is warmer than last time. The extreme, reported by buoy 17659, is 1.1° warmer than the previous extreme. A cold anomaly feature has developed around buoy 14649 at 30°S, 75°E. It reports an anomaly 2.4° colder than last time. Other buoys in the area have shown modest warming in their anomalies. The warm anomaly which was south of New Zealand (55°S, 165°E) has decayed, with anomalies reported by buoys 56622 and 54664 being 0.7° cooler on the average. The remaining features show only small changes since last time.



AUG 5-8/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: August 10 - 14, 1979

The number of reporting buoys is 160. The average sea surface temperature anomaly is 0.81°. The warm anomaly east of Argentina has become cooler. Buoy 17662 (48°S, 55°W) reports an anomaly 1.2° cooler than previously. Buoy 54643 to the east (43°S, 40°W) reports a slightly cooler anomaly as well, and the feature centred on this buoy has linked to that centred about buoy 54646. The anomaly reported by buoy 17659 (45°S, 10°W) is 1.0° warmer, but the feature has not changed much. The cold anomaly between Madagascar and Africa (25°S, 40°E) has become colder with buoy 14627 now reporting an anomaly 2.0° colder than before. This is the same buoy as was reporting cold anomalies from this region about a month ago. The warm anomaly at 40°S, 50°E is even warmer than last time. The extreme is reported by buoy 17752, a buoy which did not report last time. The 2 other buoys in the region show slightly cooler anomalies from last time. The two cold anomalies in the Pacific (20°S, 180°W and 30°S, 150°W) appear to be separating. Buoys from the region between these features show no trend in reported anomalies. Finally, the large warm anomaly west of Chile (40°S, 80°W) is cooling, although the extreme, still reported by buoy 17609, is the same as before.

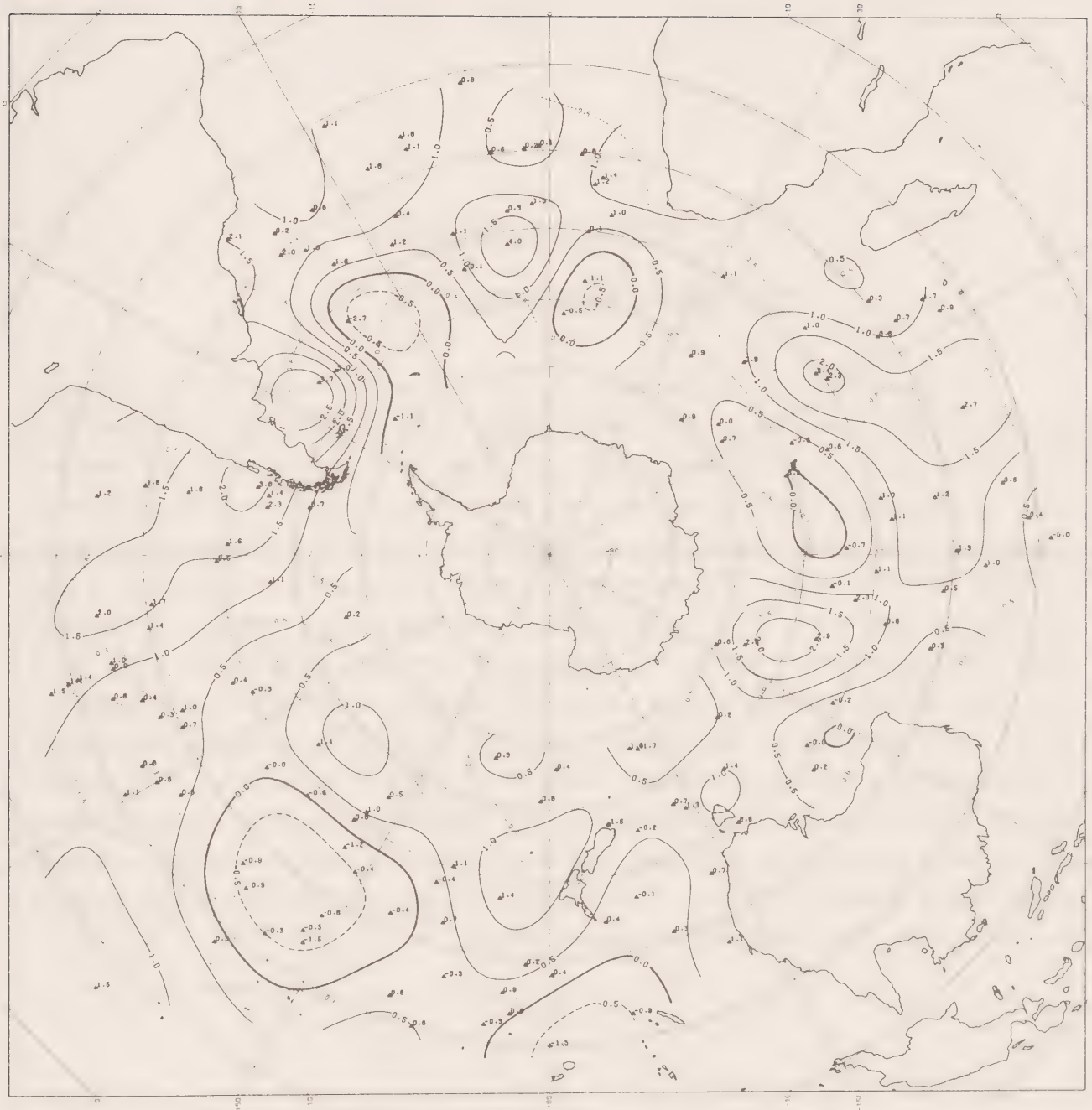
AUG 10-14/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE. CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: August 15 - 19, 1979

The number of reporting buoys is 159. The average sea surface temperature anomaly is 0.68°C. The cold anomaly formerly at 35°S, 40°E does not appear this time. Although temperatures reported by buoy 14627 did not appear to be bad, the anomaly this time was -6.5°. This was about five standard deviations from the mean of the climatology, and so was eliminated. The cold anomaly at 45°S, 40°W has expanded slightly with the extreme reported by buoy 54643. Only buoys 54643 and 54646 are enclosed by this feature. The cold anomaly at 50°S, 10°E is also stronger about buoys 17606 and 17608. On average, the anomalies reported by these buoys are 0.5° colder. The strong warm anomaly at 40°S, 60°E has diminished in strength with the extreme, reported by buoy 17752, being 2.0° cooler than last time. The cold anomalies in the Pacific Ocean (25°S, 180°W and 30°S, 140°W) both appear to be getting colder. The more eastern feature has expanded to the east and now encompasses 10 buoys. The warm anomaly east of Argentina (45°S, 60°W) has become warmer with both buoys 17662 and 17649 reporting anomalies warmer than 3.0°.



AUG 15-19/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: August 20 - 24, 1979

The number of reporting buoys is 160. The average sea surface temperature anomaly is 0.75°. The warm anomaly east of Argentina (45°S, 60°W) has shown a warming trend since last time. The anomaly reported by buoy 17649, some 1.9° warmer than last time, is responsible. The very large anomaly reported by this buoy has been retained in the anomaly map simply because this region shows large standard deviations (on the order of 3°) in the climatology. The warm anomaly south of Madagascar (40°S, 50°E) is also warmer than last time. Buoy 17659 reports the extreme of 4.5°, which is 1.2° warmer than the previously-reported extreme anomaly. To the east, buoy 16609 (45°S, 75°E) reports an anomaly of 3.7°, which is substantially different from the surrounding reports. In the last 5-day interval, it reported an anomaly of 0.8°. Although the temperature records showed a steady increase, the reliability of this buoy is suspect. In the Pacific Ocean, both of the cold anomalies have expanded. The anomaly at 25°S, 170°E has pushed to the south due to cooler anomalies reported on the east coast of Australia and buoy 56622 failing to report this time. The other cold anomaly, at 30°S, 140°W, has expanded in all directions. The anomaly now encloses 11 buoys.

AUG 20-24/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE. CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: August 25 - 29, 1979

The number of reporting buoys is 155. The average sea surface temperature anomaly is 0.76°. The warm anomaly east of Argentina (45°S, 60°W) has cooled with the extreme anomaly being 1.3° cooler than last time. The cold anomaly formerly at 50°S, 15°E has disappeared with buoys 17606 and 17608 reporting warm anomalies now. The warm anomaly at 40°S, 55°E has warmed even more. The extreme, reported by buoy 17659, is now 1.1° warmer than before and is more than 3 standard deviations above the climatological data. For this reason, the temperature reported seems suspect. The cold anomaly north of New Zealand (25°S, 170°E) has retreated north slightly. Temperatures along the east coast of Australia continue to drop slightly. The cold anomaly at 30°S, 140°W has expanded to the east to about 110°W. Fourteen buoys in the area report cold anomalies.

AUG 25-29/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: August 30 - September 3, 1979

The number of reporting buoys is 152. The average sea surface temperature anomaly is 0.76°. Since last time, the warm anomaly reported by buoy 17649 at 45°S, 50°W has warmed 1.2°. Buoy 17662, which is in nearly the same location, reports a similar high anomaly. A warm anomaly seems to be forming near 40°S, 10°E centred on buoy 17762. The very warm anomaly at 40°S, 60°E is cooler this time. The change is due likely to buoy 17659 failing to report this time. A cold anomaly has developed around buoys 16609 and 74628 at 45°S, 80°E. Last time, buoy 16609 reported an anomaly of 2.2°. A cold anomaly appears to be forming in the Great Australian Bight (40°S, 130°E); three buoys are responsible. The cold and warm anomalies of the western Pacific are little changed since last time. With the northward extension of the warm anomaly east of New Zealand, the cold anomaly to the north has retreated further north. The major change in the features in the Pacific Ocean is a new warm peak centred at 30°S, 90°W about buoys 17654 and 54636.

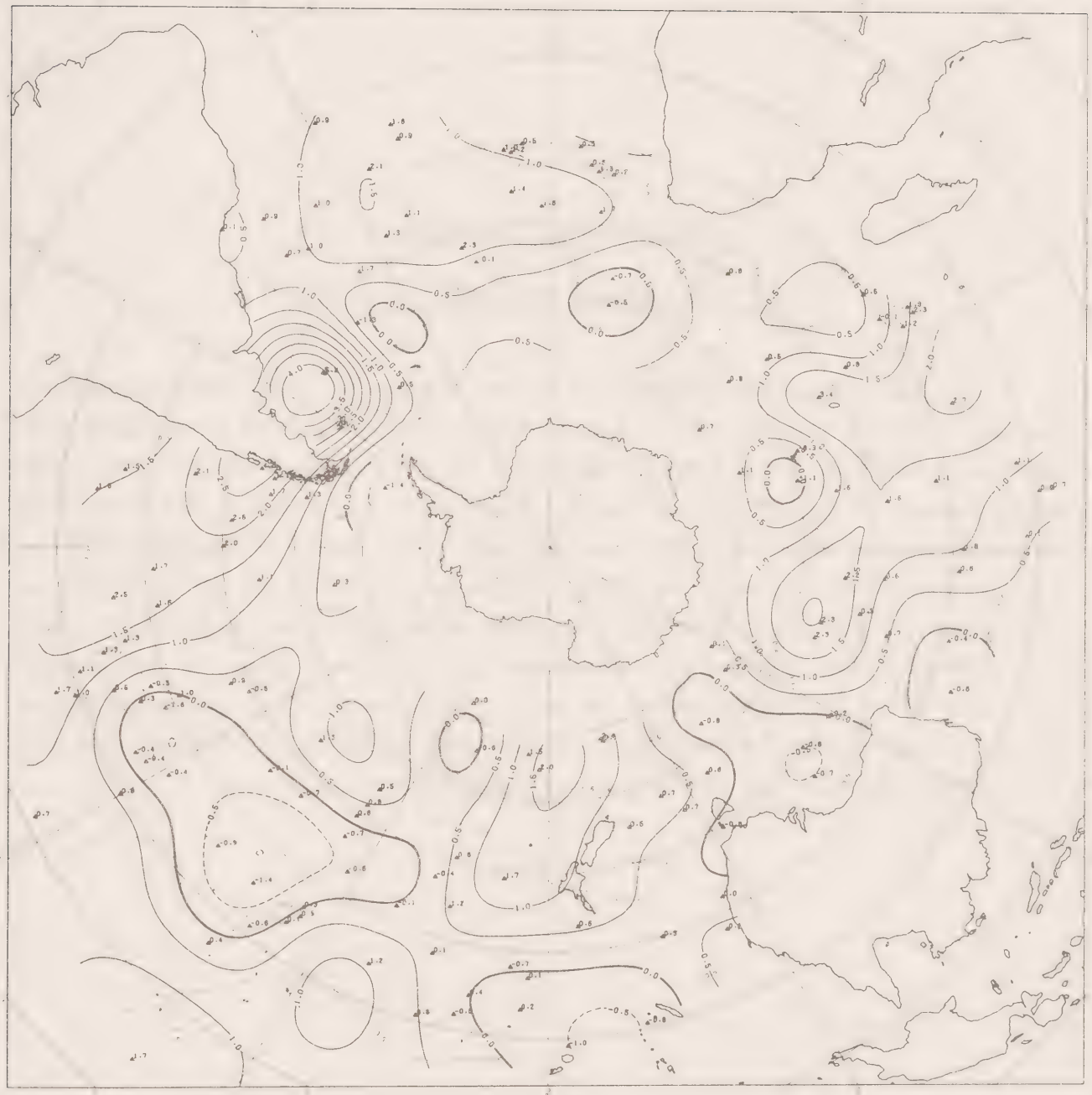
AUG 30 - SEPT 3/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: September 4 - 8, 1979

The number of buoys reporting is 155. The average sea surface temperature anomaly is 0.76°C. Since last time, the warm anomaly east of Argentina (45°S, 60°W) has warmed further with two buoys, 17649 and 17662, reporting anomalies greater than 5°. The warm anomaly near 40°S, 60°E has cooled considerably and shifted its centre further east. Part of this is caused by buoy 17659 failing to report this time, when last time it reported an anomaly of 5.6°. The warm anomaly southwest of Australia (45°S, 105°E) has warmed with three buoys reporting anomalies greater than 2°C. A cold anomaly has expanded south from Australia (45°S, 135°E) to enclose 6 buoys, where before only 2 reported cold anomalies. The cold anomalies of the Pacific (20°S, 180°W and 30°S, 135°W) are both stable. Finally, the warm anomaly off the coast of Chile (40°S, 80°W) has warmed, with the maximum anomaly of 4.3° reported by buoy 17609.



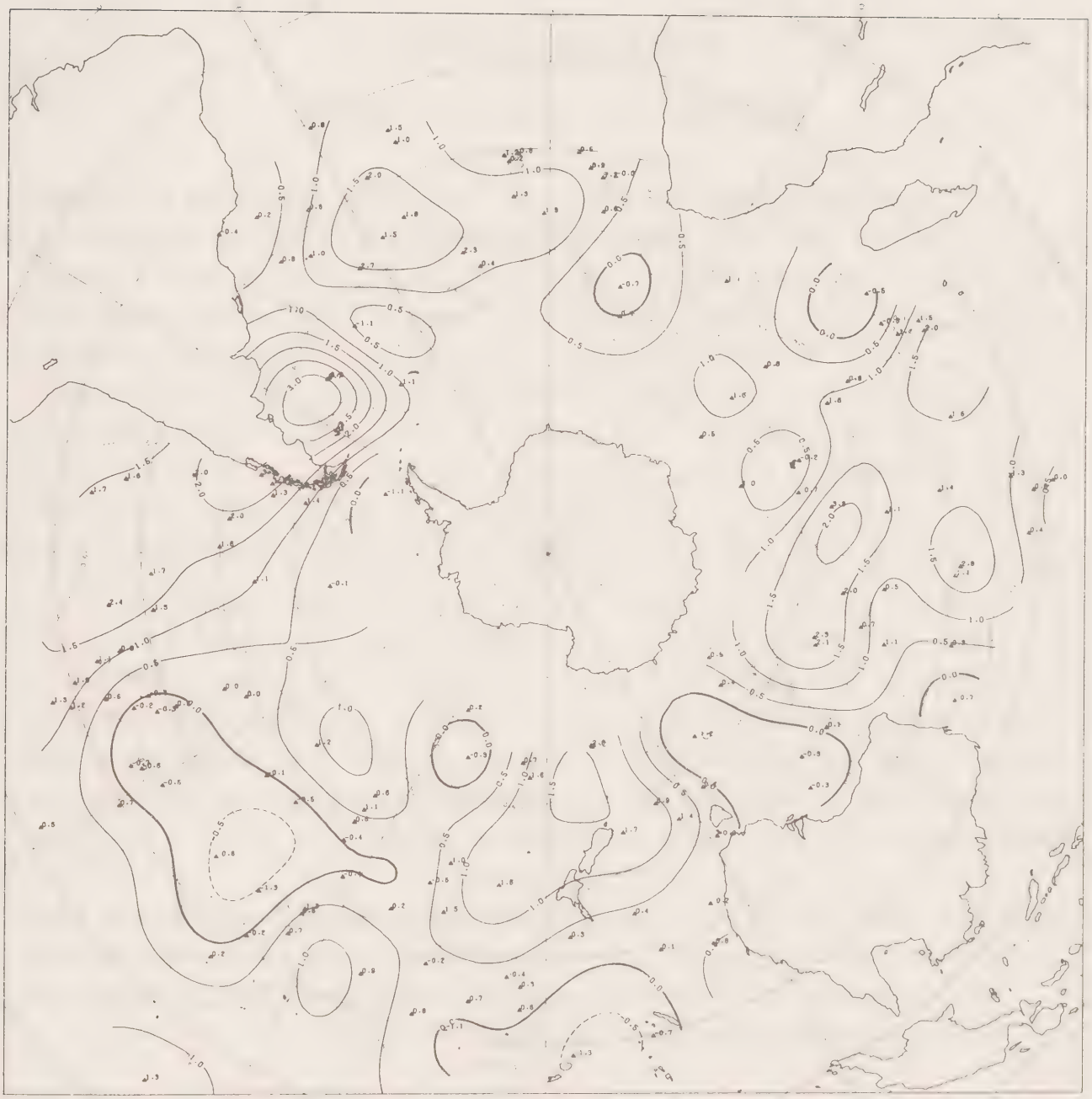
SEPT 4-8/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: September 9 - 13, 1979

The number of reporting buoys is 154. The average sea surface temperature anomaly is 0.77°C. The warm anomaly east of Argentina (45°S, 55°W) is cooler now with both buoys 17649 and 17662 reporting anomalies about 1.5° cooler than last time. The warm anomaly of the central Atlantic is slightly warmer now with 7 buoys reporting anomalies greater than 1.5°. The warm anomaly in the Indian Ocean (45°S, 90°E) is slightly warmer and centred on buoy 16609, which reports an anomaly 2.2° warmer than last time. The cold anomaly south of Australia shows warmer temperatures from last time with only 5 buoys reporting cold anomalies. The warm anomaly east of New Zealand (50°S, 180°W) has expanded in area to the west of New Zealand. The 2 cold anomalies in the Pacific Ocean are stable. The warm anomaly west of Chile (40°S, 75°W) is cooler this time primarily because buoy 17609 reports an anomaly almost 0.5° cooler.



SEPT 9-13/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

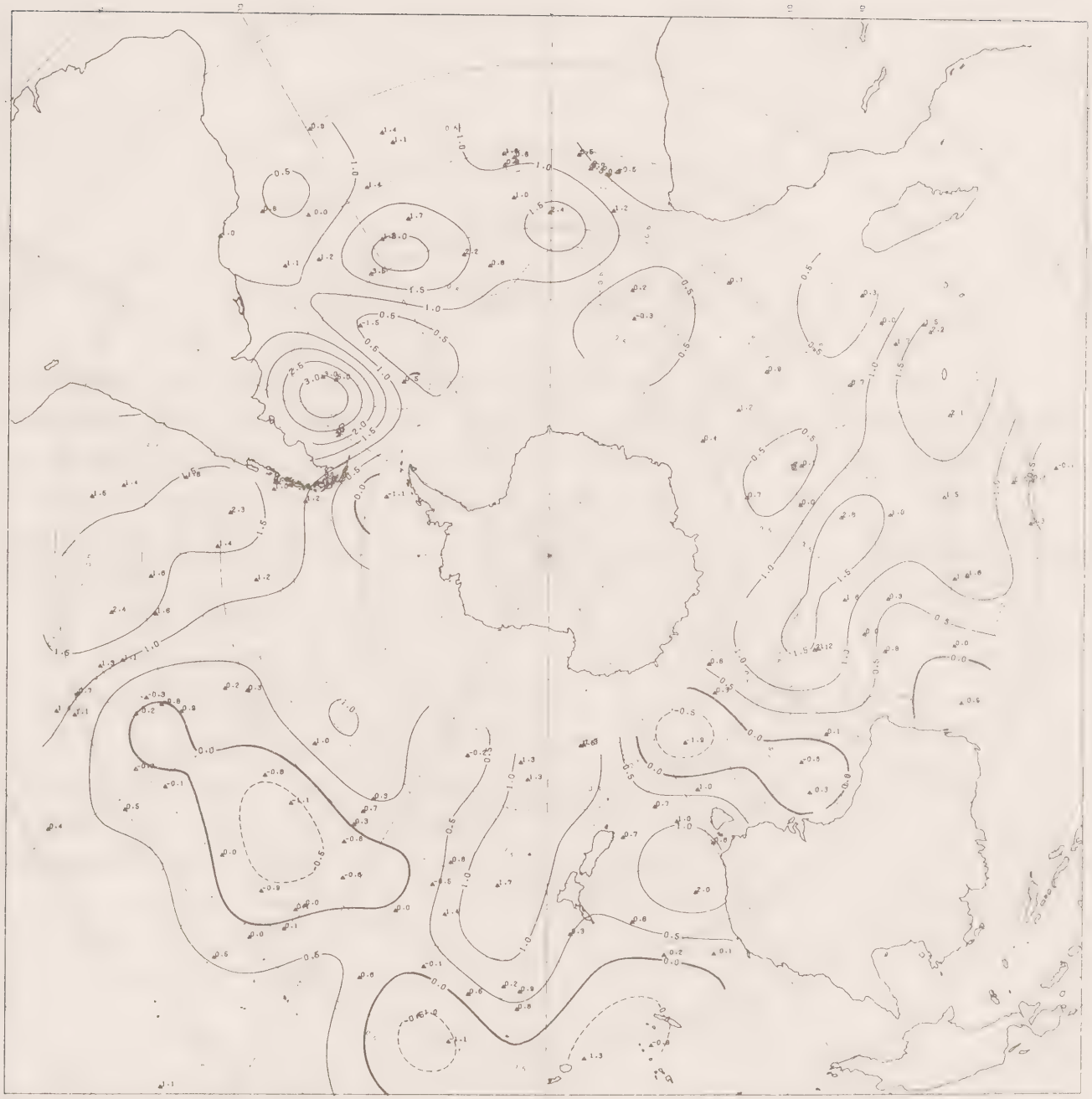
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: September 14 - 18, 1979

The number of reporting buoys is 149. The average sea surface temperature anomaly is 0.72°C. The warm anomaly east of Argentina (45°S,55°W) is stable in area. The average anomaly of the 2 buoys in the region rose slightly since last time. The whole of the Atlantic Ocean now shows warm anomalies. Buoy 17653 reports an anomaly 0.7° warmer than before. The Indian Ocean is also completely dominated by warm anomalies. The extreme formerly at 45°S,100°E has cooled slightly with the peak anomaly reported by buoy 16609 being 1° cooler than before. The cold anomaly south of Australia (45°S,135°E) has shifted to centre on buoy 54657, reporting an anomaly 0.7° cooler than last time. Only 3 buoys report cold anomalies from this region. The warm anomaly centred on New Zealand shows cooler anomalies this time, but has extended further to the west to contact the Australian coast. This is caused by the warm anomaly reported by buoy 17620. The cold anomaly north of New Zealand (20°S,180°W) has extended eastward. This anomaly is now defined by 7 buoys. The cold anomaly further to the east at 30°S,135°W shows slight boundary changes, but maximum recorded anomalies are about the same as last time. Finally, the warm anomaly west of Chile has cooled further with buoy 17609 failing to report this time. There is still, however, warmer water than the climatic mean off the entire west coast of South America.

Note: Buoy 54641 (60°S,45°W) is still reporting anomalously high temperatures. This anomaly has been deleted from the maps because it is not consistent with surrounding data. If it were to be included, it would extend the warm anomaly east of Argentina south to the Weddell Sea region.



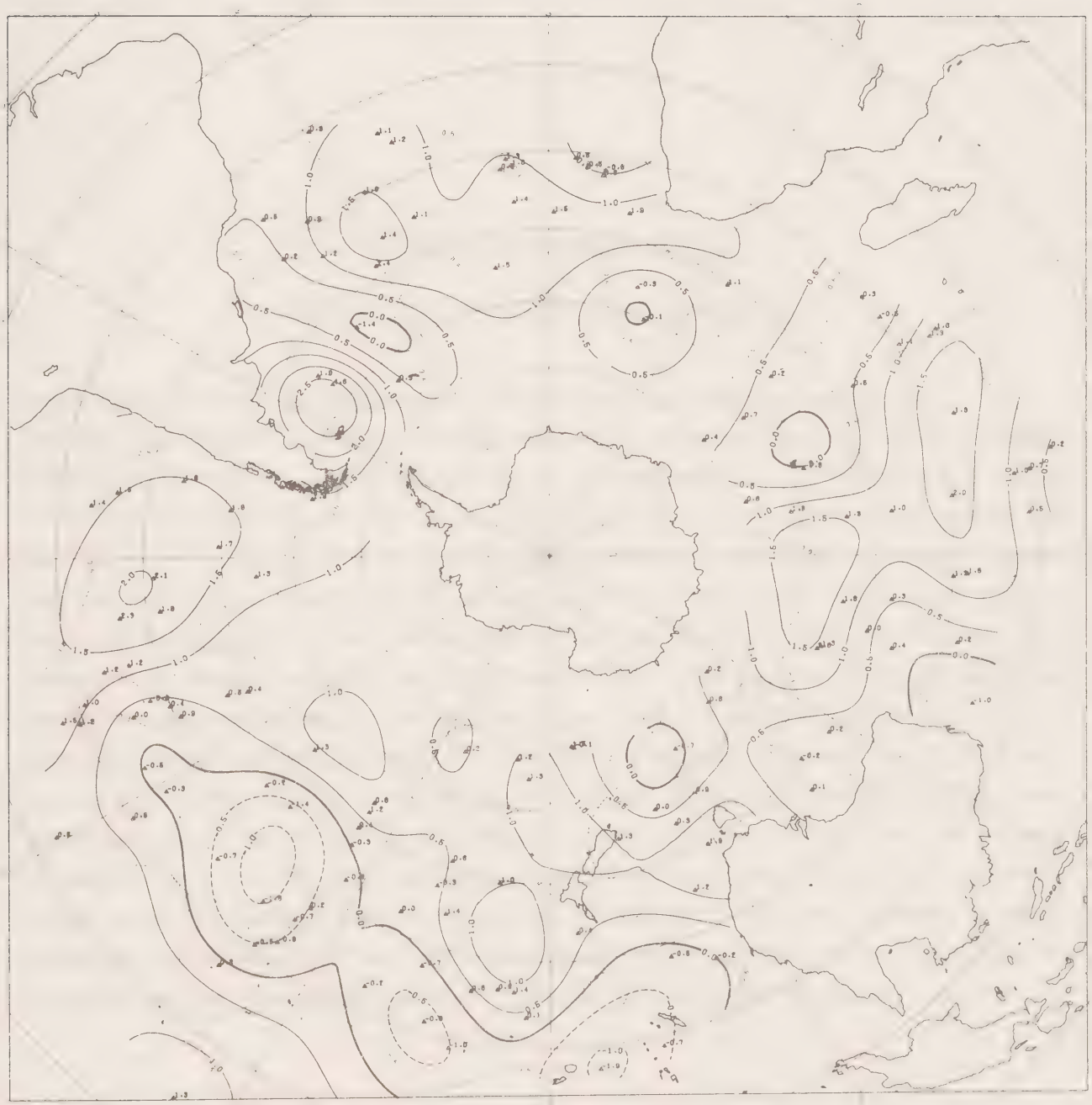
SEPT 14-18/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE. CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: September 19 - 23, 1979

The number of reporting buoys is 146. The average sea surface temperature anomaly is 0.68°C. The warm anomaly east of Argentina is cooler. Buoy 17649 shows the largest change, reporting an anomaly 1.1° cooler than last time. The South Atlantic is still dominated by warm anomalies, although the larger anomalies, reported by buoys 17653 and 17767, are cooler than last time. The Indian Ocean is also dominated by warm anomalies. Only 2 buoys, 16601 and 14631, report cold anomalies. The cold anomaly south of Australia has all but disappeared. Only 3 quite separate buoys report cold anomalies this time. The largest warming of an anomaly is 1.2°, reported by buoy 54657. The formerly separated cold anomalies in the Pacific have now combined to stretch from 150°E to 120°W between 20 and 30°S. Maximum anomalies in each lobe are colder than last time by almost 1°C. There are 20 buoys defining this large anomaly where before there were 15. The warm anomaly west of South America has shifted to centre on buoy 54636. It has also warmed with the 2 other buoys in the region, 17654 and 74605, reporting slightly warmer anomalies on average.



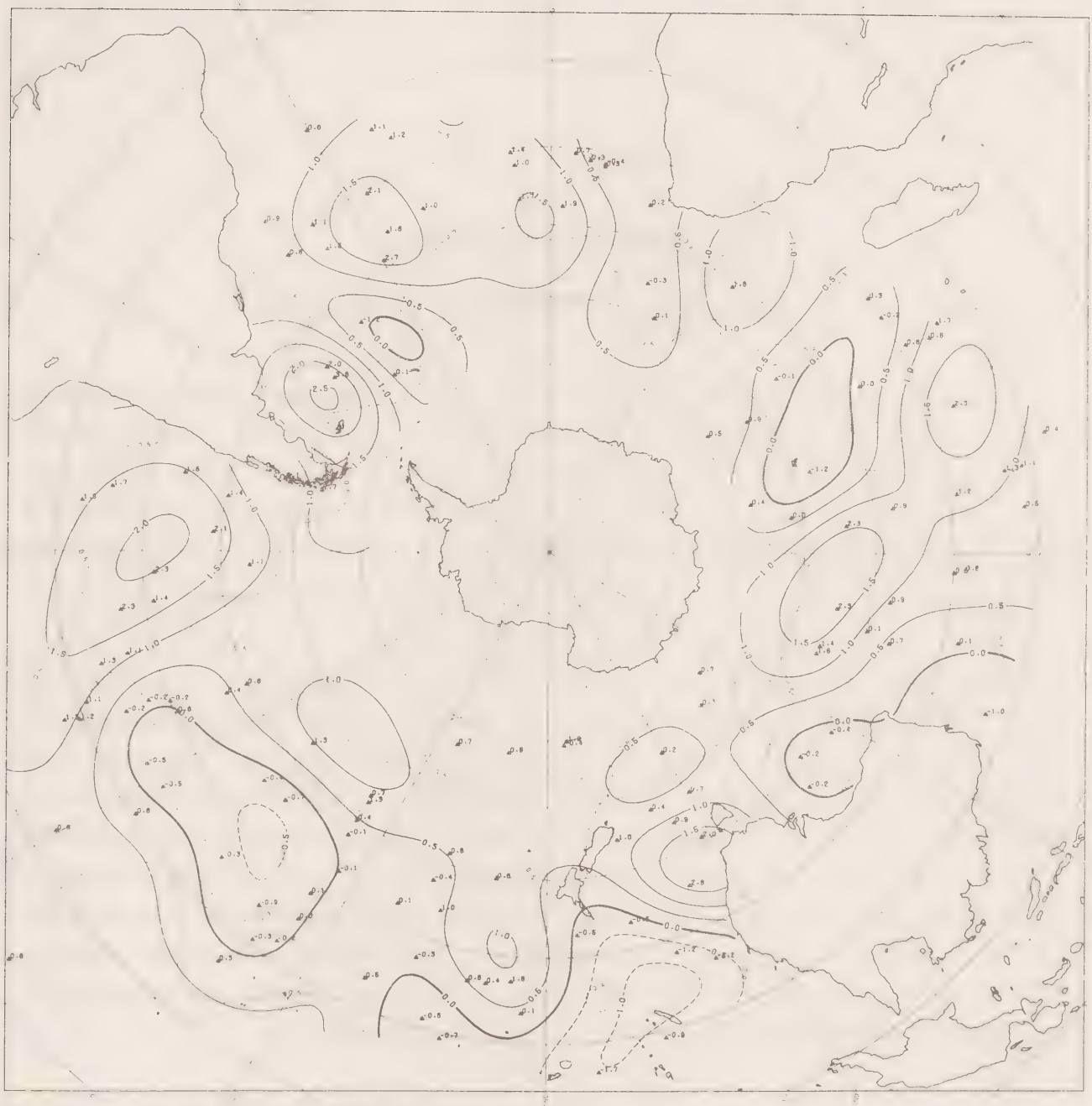
SEPT 19-23/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: September 24 - 28, 1979

The number of reporting buoys is 144. The average sea surface temperature anomaly is 0.66°C. Since last time, the warm anomaly east of Chile (50°S, 55°W) has cooled slightly, with the average anomaly reported being 2.9°. The central Atlantic is still dominated by a warm anomaly, but temperatures have fallen in the area south of Africa. Now only buoy 17608 reports a cold anomaly in this region. The small cold anomaly in the Indian Ocean (45°S, 65°E) has expanded with 5 buoys in the area reporting cooler anomalies. The expansion of this feature seems due to the large drop in the anomalies reported by buoys 16601 and 74628. A cold anomaly has reappeared just south of Australia (35°S, 130°E) with 3 buoys reporting cold anomalies on average 0.3° cooler than last time. The warm anomaly formerly east of New Zealand has shifted to centre near the coast of Australia (40°S, 150°E). This is the result of buoy 17620 reporting an anomaly warmer than last time by 1.4° and buoys east of New Zealand reporting cooler anomalies. The large cold anomaly in the Pacific has again divided into 2 separate features, probably because of the slightly warmer anomalies reported by buoys 54632, 54634 and 17674. The feature further to the east (30°S, 135°W) shows warmer anomalies on average, with the extreme reported by buoy 17635 and being 0.9° warmer than last time.



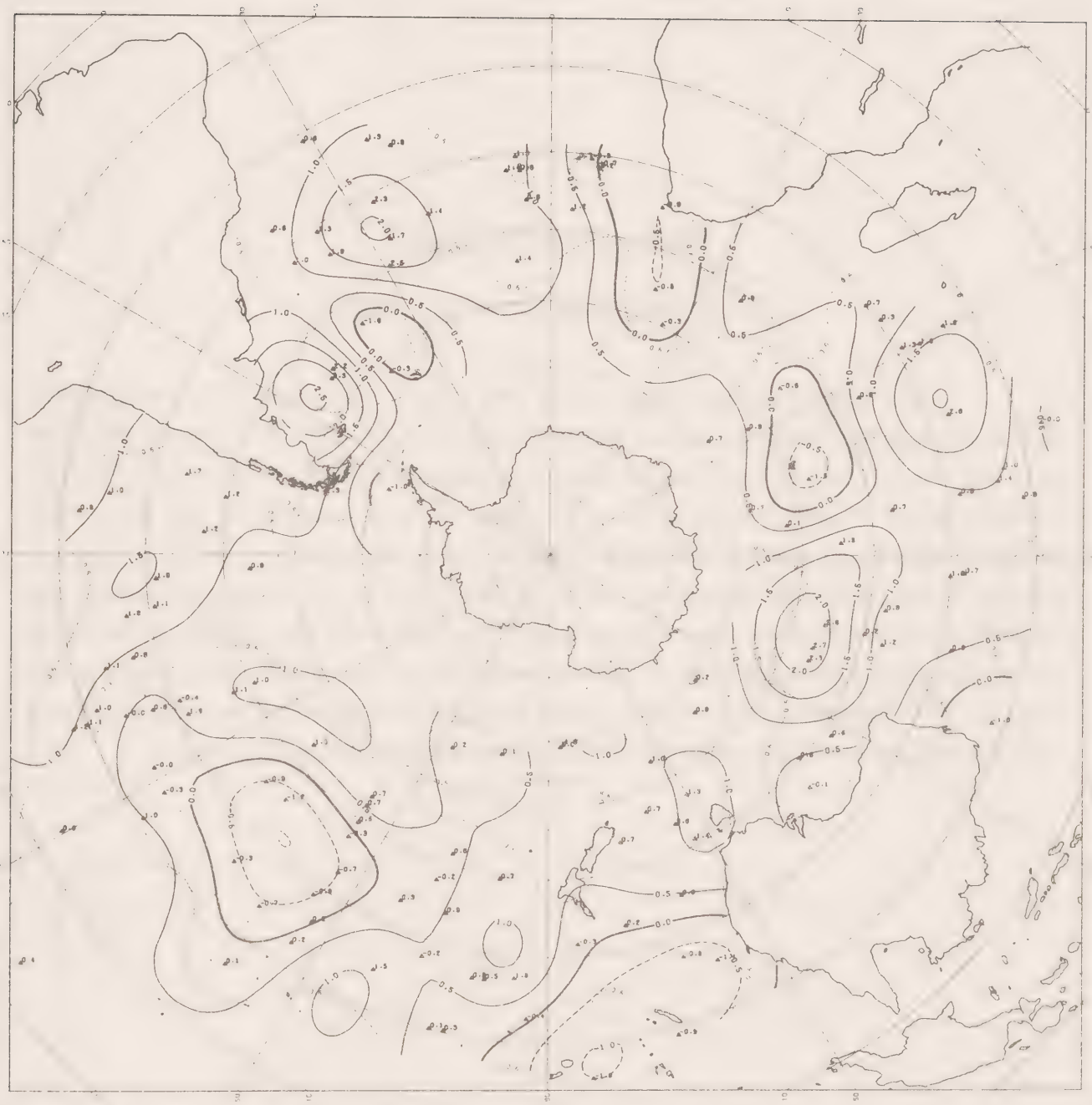
SEPT 24-28/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: September 29 - October 3, 1979

The number of reporting buoys is 144. The average sea surface temperature anomaly is 0.65°C. In the central Atlantic, the broad warm anomaly has been cut off from the coast of Africa. Anomalies in this warm feature (35°S, 30°W) are slightly warmer than before. The cold anomaly south of Africa (45°S, 15°E) has developed with 5 buoys reporting cold anomalies where before there was only 1. The cold anomaly in the Indian Ocean (45°S, 70°E) is still centred about buoy 16601, but the feature now encloses buoy 17766 as well. The warm anomalies in the Indian Ocean have split into 2 (30°S, 70°E and 50°S, 105°E). Both features show warmer anomalies than before. The cold anomaly south of Australia has disappeared again, as has the warm anomaly which was off the east coast (40°S, 150°E). The latter disappearance is because buoy 17620 now reports an anomaly 2.0° cooler than before. The cold anomalies in the Pacific have shown further adjustments from last time. The division between the 2 features has widened to about 30 degrees of longitude. Two of the 3 buoys in the band from 150 to 180°W formerly reporting cold anomalies now report warm anomalies. The more easterly feature (30°S, 135°W) is smaller in size and now is defined by 8 buoys where before there were 13. Finally, the warm anomaly in the eastern Pacific has cooled generally but broadened to encompass all latitudes from South America to 120°W longitude.



SEPT 29 - OCT 3/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: October 4 - 8, 1979

The number of buoys reporting is 144. The average sea surface temperature anomaly is 0.64°C. The warm anomaly east of Argentina (45°S, 55°W) is much cooler now with the 2 buoys in the region reporting anomalies 0.6° cooler on average. The cold anomaly south of Africa covers about the same area as previously, but the coldest anomaly, reported by buoy 17608, is 0.5° colder. The warm anomaly at 50°S, 105°E is slightly cooler with peak anomalies cooler by about 0.5°. The areal coverage of this feature is reduced as well. The cold anomaly in the Pacific (30°S, 140°W) is stretched to the north and is defined by 10 buoys, where before there were only 8. The warm anomaly west of South America has dispersed further since last time, so that now the whole area lies only slightly above the mean sea surface temperature anomaly.

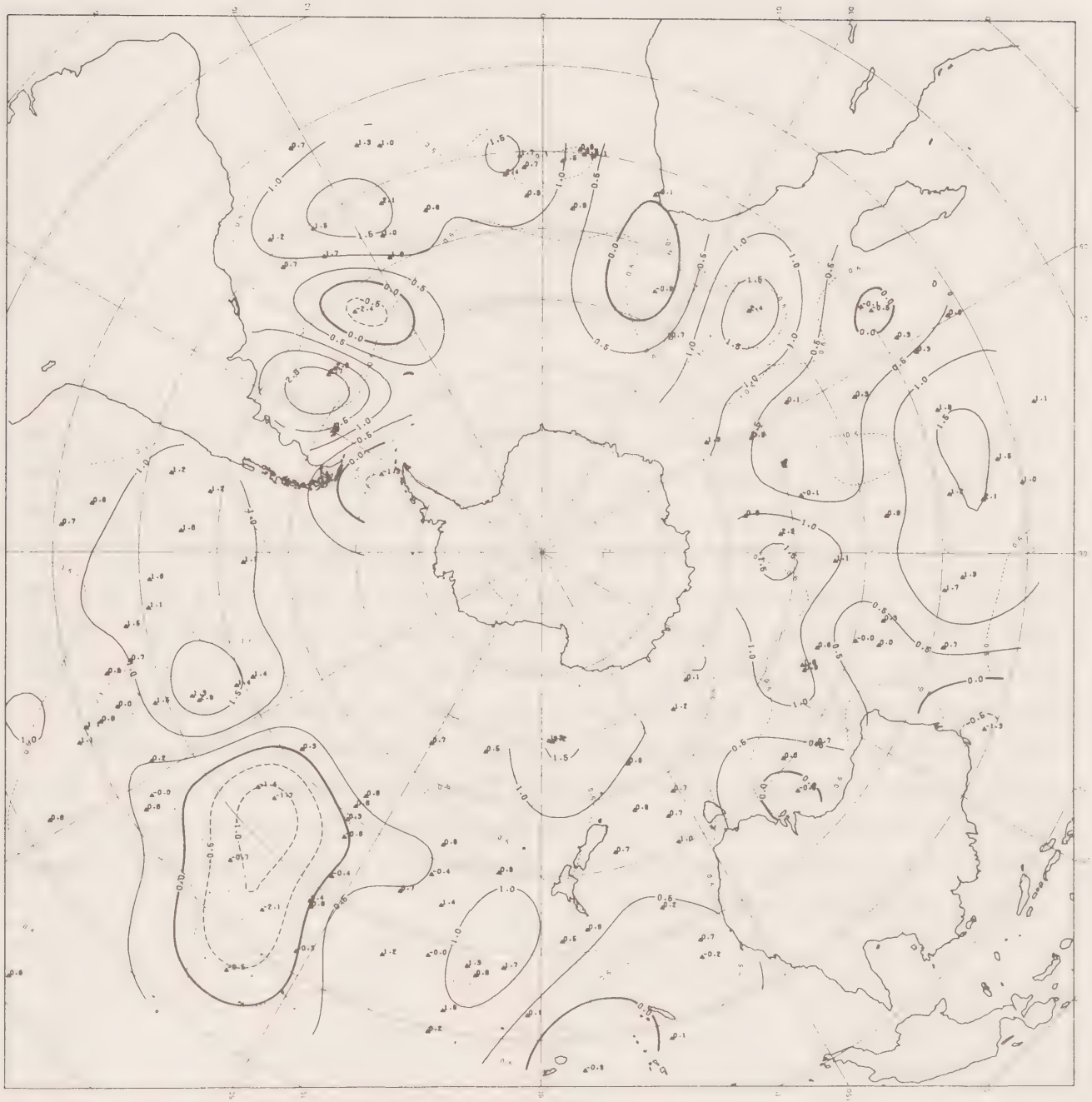
OCT 4 - 8/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: October 9 - 13, 1979

The number of reporting buoys is 140. The average sea surface temperature anomaly is 0.73°C. The anomaly east of Argentina shows warmer anomalies from last time. The 2 buoys defining this feature report anomalies 0.6° warmer. The warm anomaly of the central Atlantic (30°S, 30°W) reports slightly cooler peak anomalies, but has extended about 30° longitude to the east. The reason for this is the warm anomaly reported by buoy 17754 being 2.0° warmer than last time. A warm anomaly has developed centred on buoy 17771, which reports an anomaly 1.6° warmer than before. The warm anomaly at 25°S, 75°E is cooler and spread out from last time. The maximum anomaly is 0.5° cooler than before. The cold anomaly which was to the south (45°S, 75°E) has disappeared. Buoy 16601 reports an anomaly 1.0° warmer than before. The warm anomaly southwest of Australia (50°S, 105°E) is slightly cooler, continuing the cooling trend of the last 5-day period. The cold anomaly in the Pacific near Australia (20°S,170°E) is much warmer this time. There are only 2 buoys reporting cold anomalies now where before there were 5. The cold anomaly at 30°S, 135°W is much colder and larger than last time. The coldest anomaly, reported by buoy 17635, is 0.8° colder than before.



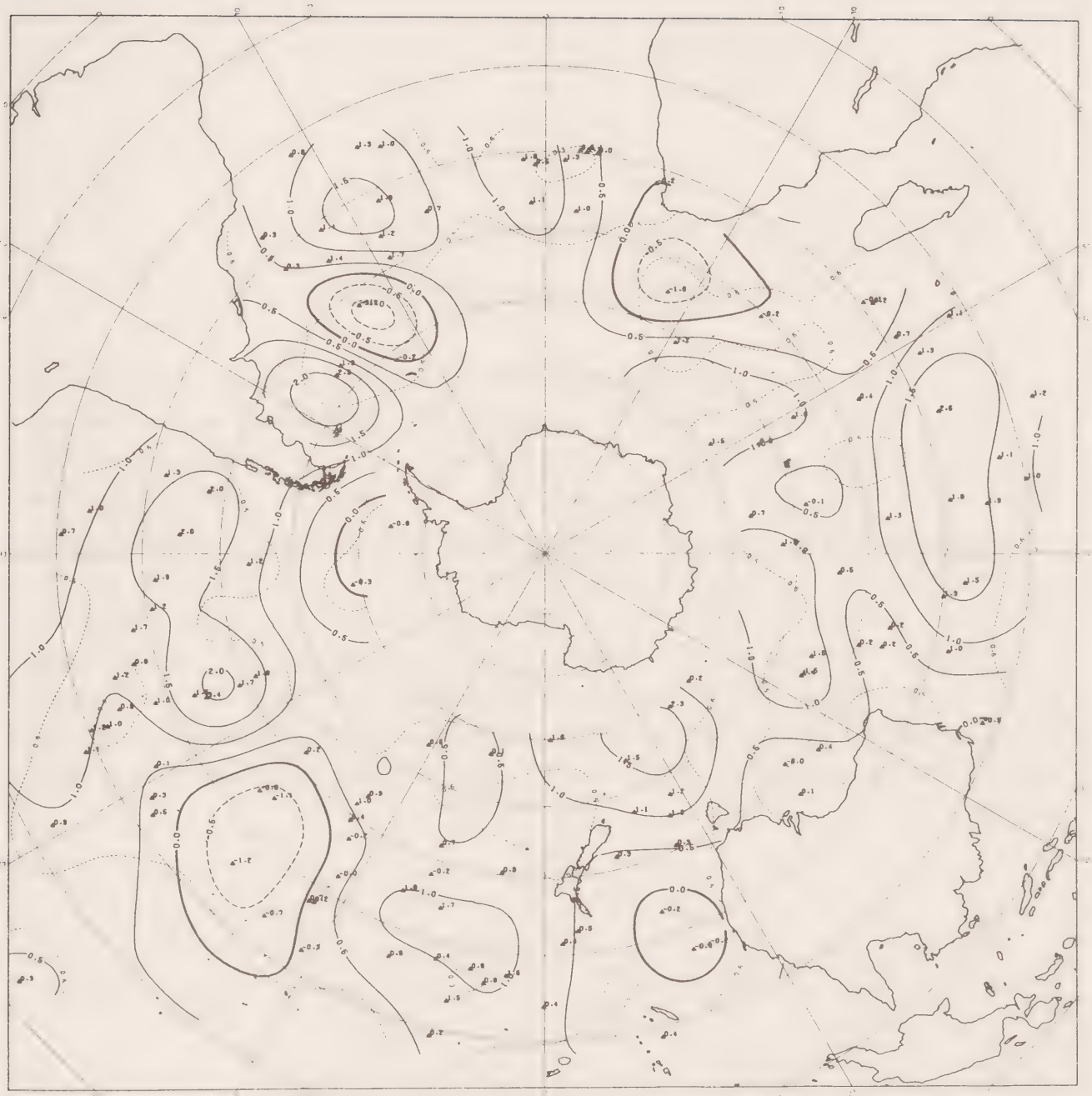
OCT 9-13/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: October 14 - 18, 1979

The number of reporting buoys is 137. The average sea surface temperature anomaly is 0.80°C. The cold anomaly east of Argentina (45°S, 30°W) is the result of the temperature reported by buoy 54643 only. Since last time, the anomaly has increased 0.8°. The cold anomaly south of Africa (45°S, 30°E) has cooled somewhat due to the colder anomaly reported by buoy 17608. The warm anomaly just to the east and centred on buoy 17771 has disappeared with this buoy reporting an anomaly 2.6° colder than last time. The cold anomaly formerly at 20°S, 170°E is gone, but a new small cold anomaly has formed to the south near the coast of Australia. The warm anomaly south of New Zealand has spread to the west now with 6 buoys reporting anomalies warmer than 1.0°. The cold anomaly of the central Pacific (30°S, 135°W) shows warmer anomalies. The largest change, recorded by buoy 17635, shows an anomaly warmer by 1.4°. Now only 2 buoys report anomalies colder than 1.0°. The warm anomaly west of South America (35°S, 105°W) shows warmer anomalies and has extended to the north. There are 17 buoys reporting anomalies warmer than 1.0°.



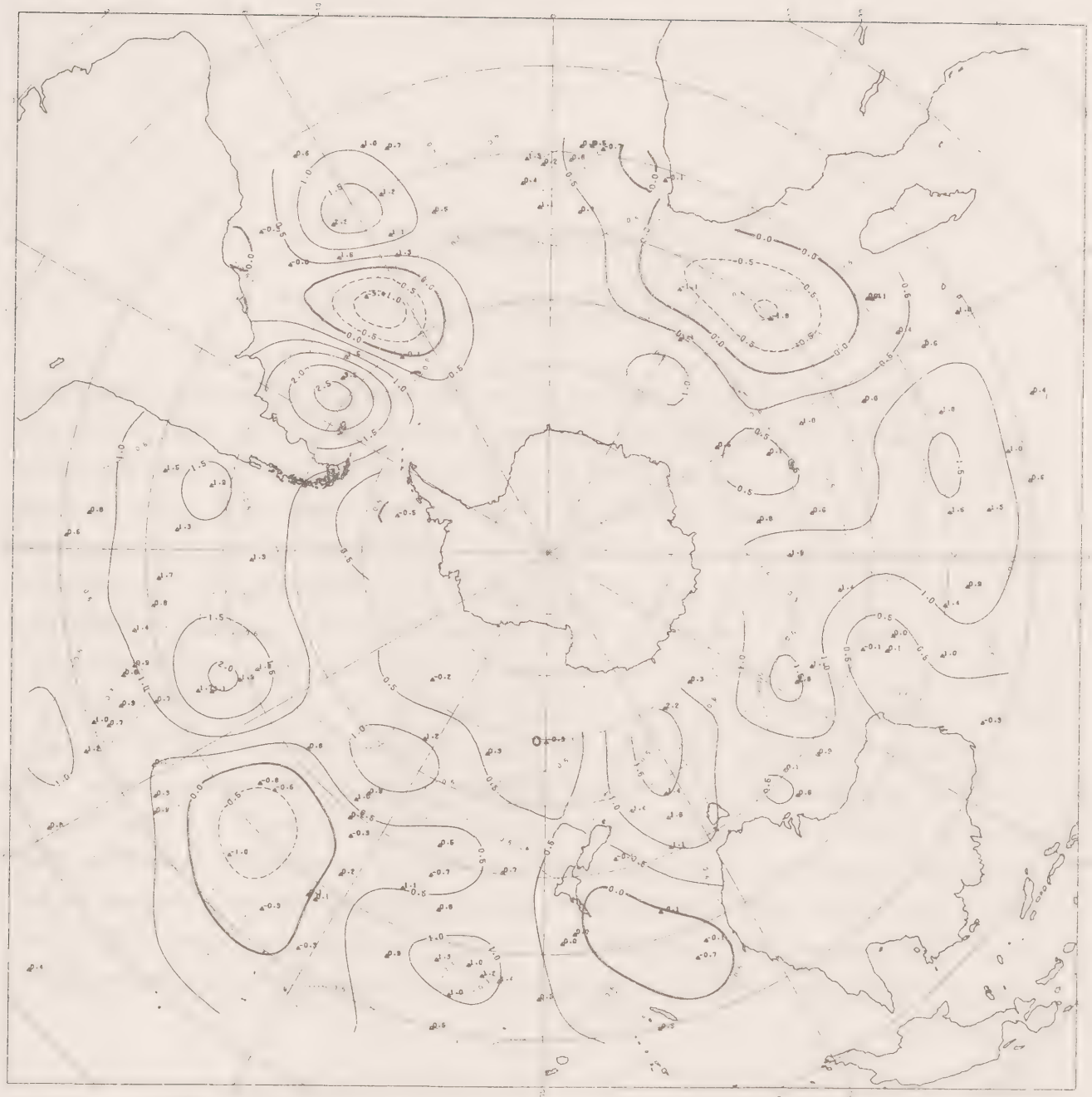
OCT 14-18/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: October 19 - 23, 1979

The number of reporting buoys is 135. The average sea surface temperature anomaly is 0.66°C. The warm anomaly reported by buoy 17662 is 0.6° warmer than last time, with the result that the warm anomaly east of Argentina has become warmer also. Buoy 54643 reports a colder anomaly than last time. The reliability of the temperatures reported by this buoy is in question. The cold anomaly south of Africa has expanded to the east because of the cold anomaly reported by buoy 17771. Even though the anomaly reported by this buoy has shown a large change over the last 10 days, its temperature records appear to be reliable. Almost all of the anomaly structure in the eastern Indian Ocean has disappeared. All of the buoys in the region about 30°S, 75°E show cooler anomalies this time by about 0.4° on average. All of the features in the Pacific Ocean are fairly stable. The largest change has been a cooling of the warm anomaly west of South America.



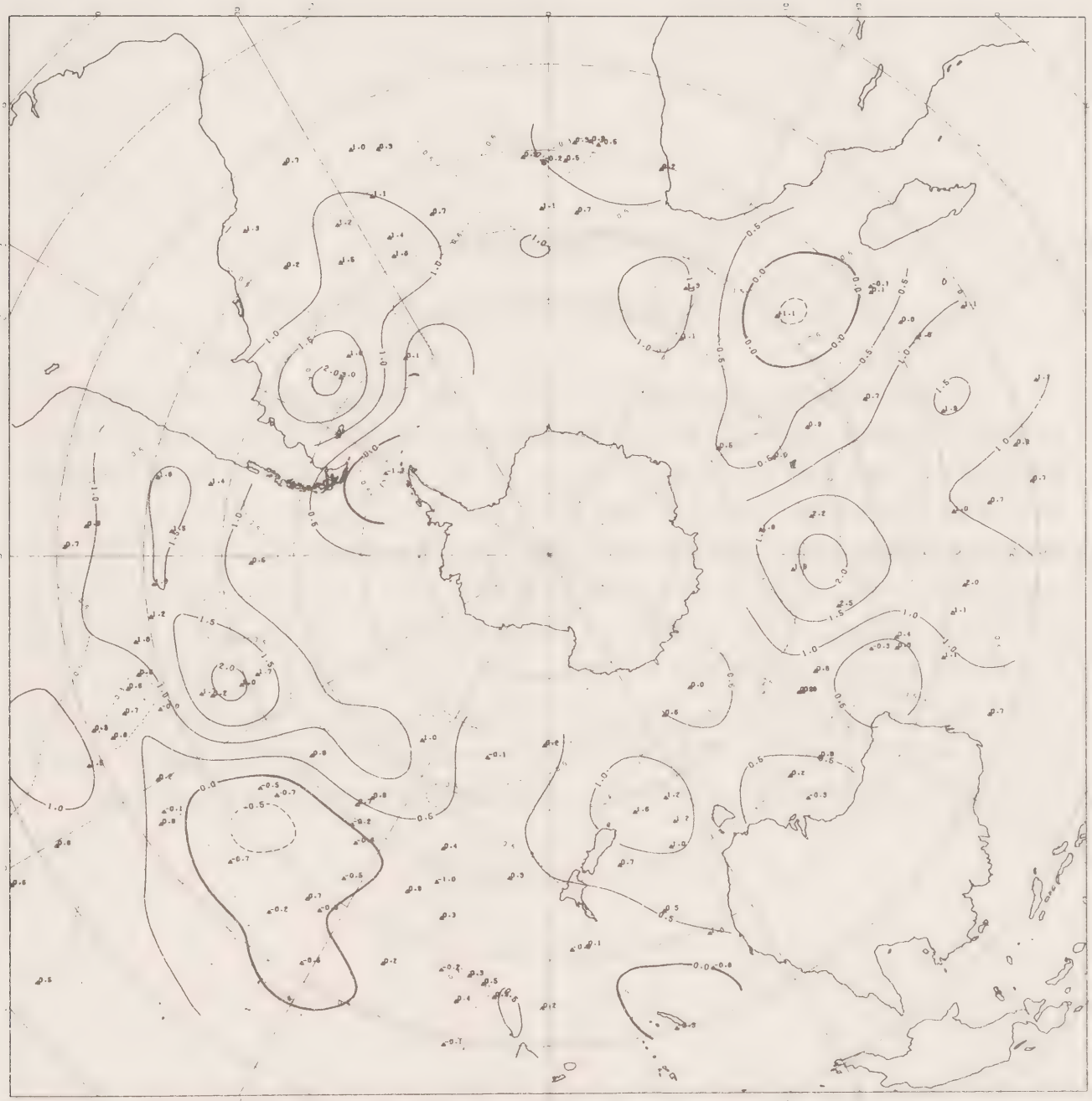
OCT 19-23/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Products

SST Anomaly Map: October 24 - 28, 1979

The number of buoys reporting is 134. The average sea surface temperature anomaly is 0.67°C. The temperatures reported by buoy 54643 became unreliable during this 5-day period. The removal of this buoy has changed the appearance of the warm anomaly east of Argentina. The other buoys in the area report little change in their anomalies. The cold anomaly formerly south of Africa has shifted to the east to centre on buoy 17771. This shift is caused by the anomaly of buoy 17608 being 2.4° warmer than last time. A new warm anomaly has formed in the Indian Ocean southwest of Australia. This is the consequence of an average increase of 0.9° reported by 4 buoys in the area. The warm anomaly south of Tasmania is cooling primarily due to buoy 17629 reporting an anomaly cooler this time by 1.6°. The cold anomaly off the northeast coast of Australia has all but disappeared. Only 3 widely separated buoys report cold anomalies. The boundaries of the cold anomaly in the central Pacific have altered somewhat but, in general, the buoys in this feature still show a warming trend in the anomalies. The extreme is now only -0.7°, where before it was 0.3° colder. The warm anomaly in the central Pacific appears to be strengthening and now dominates the western half of this ocean. Extremes are stable, with slightly warmer anomalies reported on the fringes of this feature.



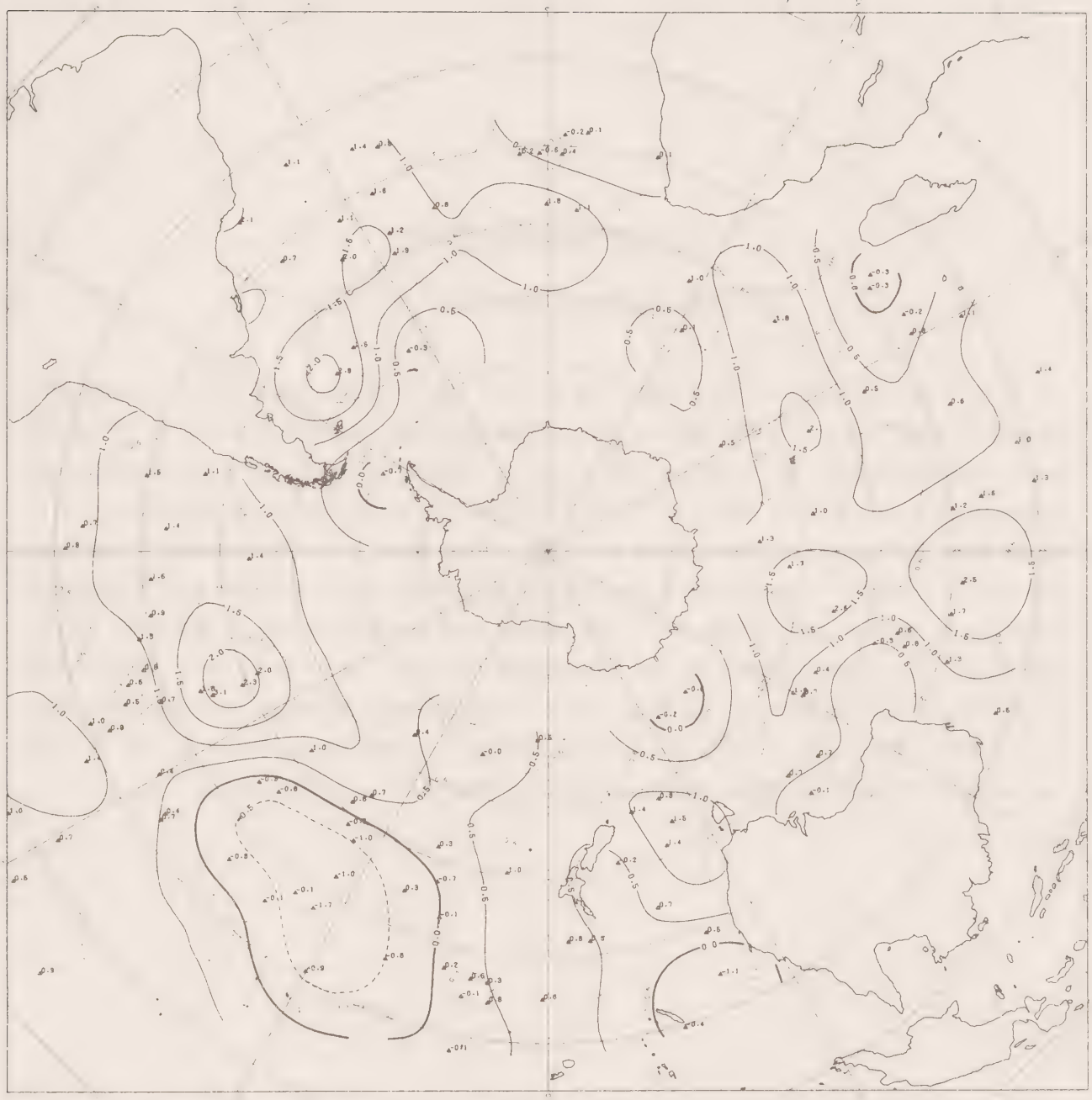
OCT 24-28/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE. CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: October 29 - November 2, 1979

The number of reporting buoys is 133. The average sea surface temperature anomaly is 0.70°C. The warm anomaly near Argentina (45°S, 50°W) shows fairly constant temperatures, but this feature has expanded to the east. A band of warm anomalies centred on 40°S latitude stretches from the coast of Argentina to about 15°E longitude. The cold anomaly which was centred on buoy 17771 (40°S, 45°E) is gone with this buoy now reporting a positive anomaly and being 2.9° warmer than last time. The cold anomaly of the central Pacific (30°S, 150°W) is stronger this time. The extreme is reported by buoy 56606 and is 1° colder than the previous extreme. As well, this time there are 5 other buoys reporting anomalies colder than the extreme last time. The warm anomaly of the eastern Pacific (40°S, 110°W) is stable but shows some cooling in its eastern regions. The extreme, again reported by buoy 54631, is almost exactly the same as last time.



OCT 29 - NOV 2/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: November 3 - 7, 1979

The number of buoys reporting is 132. The average sea surface temperature anomaly is 0.87°C. Since last time, the warm anomaly east of Argentina (45°S, 50°W) has cooled further so that it has almost lost all of its structure. A strong warm anomaly has appeared centred on buoy 17771 (40°S, 45°E). The anomaly reported by this buoy is 2.1° higher than last time. Although there has been a large change in this anomaly, it has been retained on the maps because the buoy is drifting through a region where the climatology shows large temperature gradients. The weak, cold anomaly south of Australia (60°S, 150°E) is colder now because of the 1.3° cooler anomaly reported by buoy 17629. The large cold anomaly centred at 30°S, 150°W is stable in area, although the extreme is now 0.5° warmer than last time. The warm anomaly centred about 40°S, 110°W is even warmer with 3 buoys reporting anomalies greater than 2.8° about the mean.

NOV 3-7/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

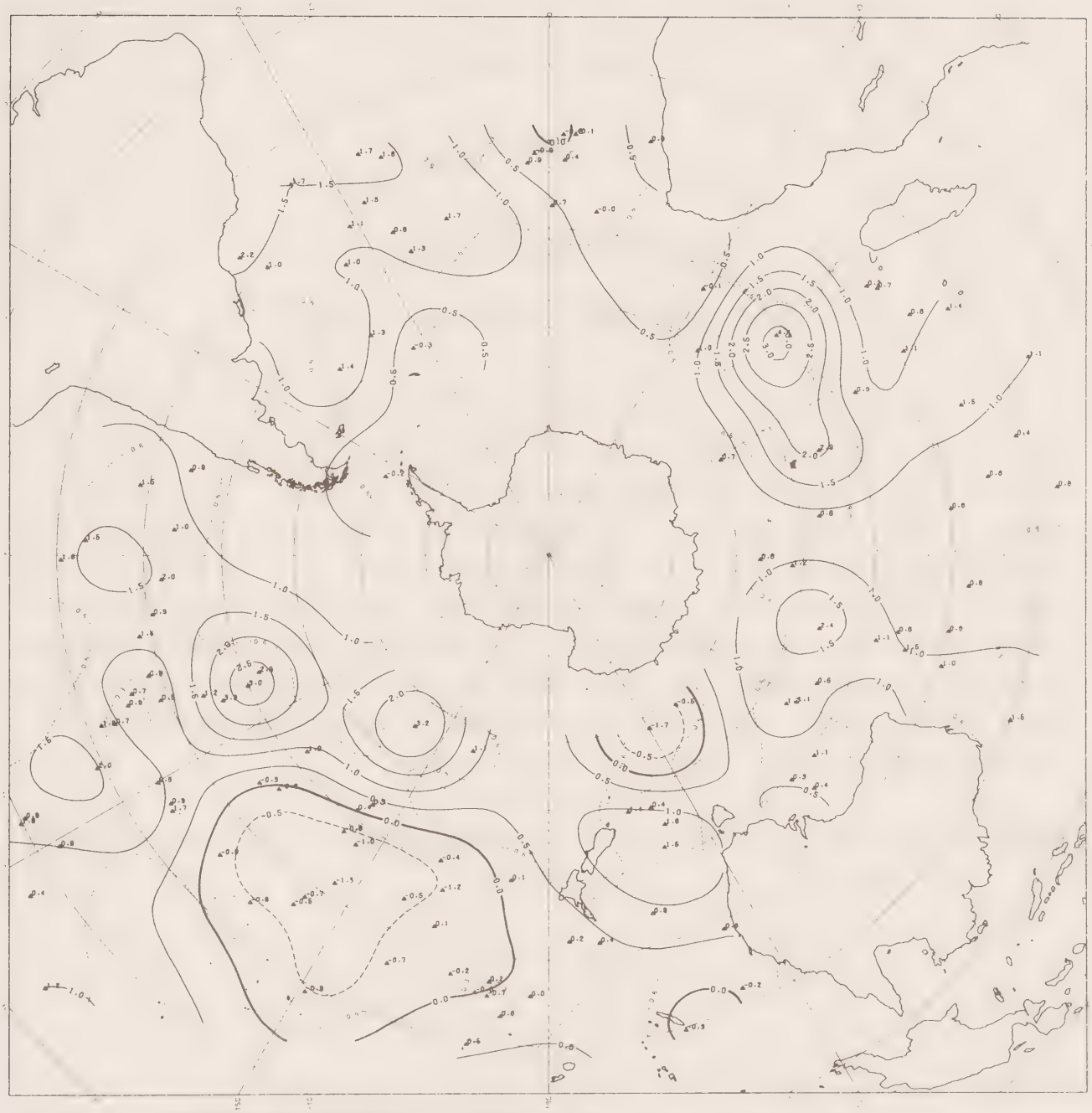
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: November 8 - 12, 1979

The number of reporting buoys is 131. The average sea surface temperature anomaly is 0.75°C. The warm anomaly east of Argentina has disappeared. There is only one buoy in the region, 17662, and it reports a modest warm anomaly of 1.4°. The warm anomaly centred on buoy 17771 (40°S, 45°E) is warmer than last time. The extreme anomaly is 4.4° and is reported by buoy 17771. The cold anomaly of the central Pacific (30°S, 150°W) has expanded in area again, although the extreme anomaly of this feature is unchanged from last time. The warm anomaly to the east (40°S, 110°W) has developed a new extreme at 55°S, 140°W centred on buoy 14624.

NOTE: It was discovered that the anomalies reported by some buoys were not plotted properly on the anomaly chart for November 3 - 7, 1979. This chart has been redone and is included in this mailing.



NOV 8-12/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

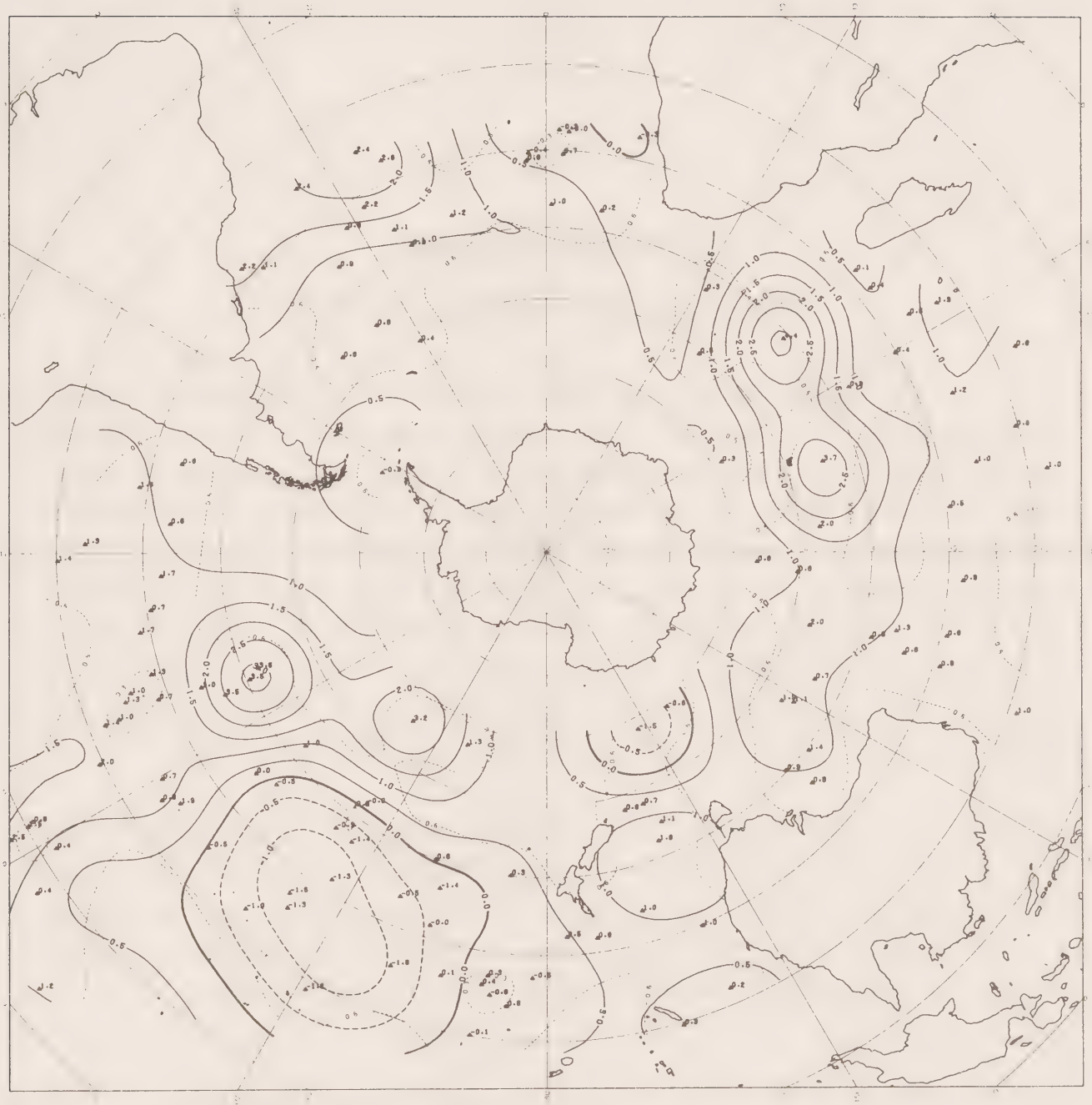
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: November 13 - 17, 1979

The number of reporting buoys is 132. The average sea surface temperature anomaly is 0.78°C. Since last time, the warm anomaly formerly centred on buoy 17771 (40°S, 45°E) has developed a second extreme about buoy 17766. This latter buoy reports an anomaly 0.8° warmer than last time. Another buoy, 16601, a little further east, also shows a large rise in the reported anomaly. The warm anomaly which was centred on buoy 16609 has been absorbed by the feature to the west. The cold anomaly of the Pacific (30°S, 150°W) shows colder temperatures. There are now 6 buoys reporting anomalies colder than -1°C, where before there were only 2. The warm anomaly centred about 40°S, 110°W is warmer with two buoys, 54630 and 54631, reporting an anomaly of 3.5°. Anomalies in excess of 1°C dominate the western Pacific.

NOTE: Buoy 54620 in the eastern Pacific has apparently been moved by ship during this last period.



NOV 13-17/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

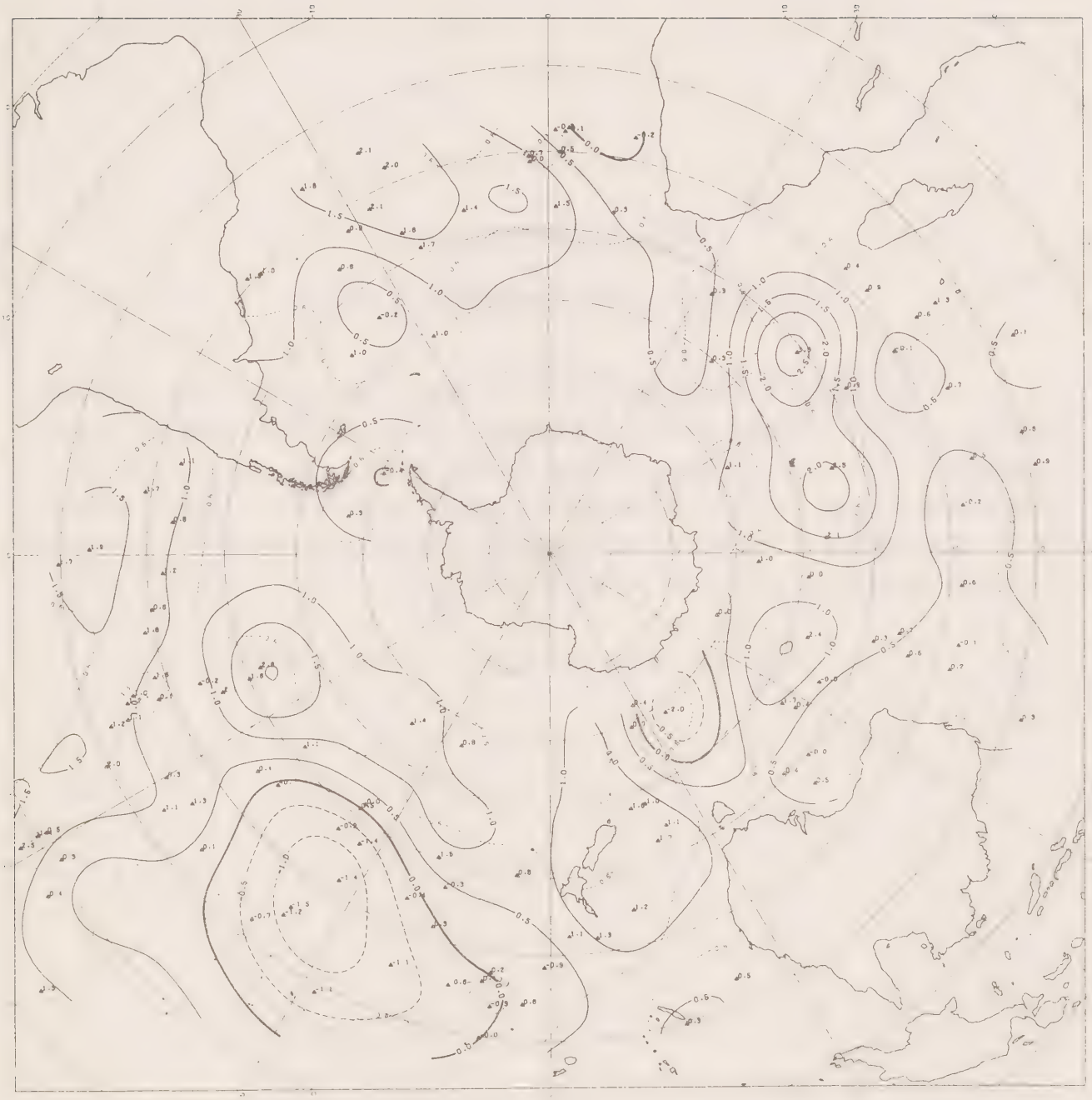
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: November 18 - 22, 1979

The number of reporting buoys was 132. The average sea surface temperature anomaly was 0.73°C. The warm anomaly in the central Indian Ocean (40°S, 60°E) shows the same double-peaked structure. The more eastern peak is weaker since buoy 17766 reports an anomaly 1.2° cooler. The other peak also shows a diminished anomaly. The cold feature south of Australia (55°S, 145°E) is stable, although now only buoy 54660 reports a cold anomaly. The cold anomaly in the Pacific (30°S, 150°W) is stable. The extreme temperature is diminished slightly, but overall the reported anomalies are stable. The warm anomalies in the eastern Pacific (45°S, 110°W) are much weaker. The extreme, reported by buoy 54621, is 0.9° cooler than last time. Buoy 14624, near 55°S, 140°W, reports an anomaly cooler by 1.8°.

NOTE: Buoys 14662 and 14663, near 60°S, 90°E, are now in a region where climatic sea surface temperatures are avilable. As shown on the track chart, their reported anomalies are in excess of 3.0°. Since these are very high and the climatic temperatures are not well determined, we have chosen to remove these buoys from the anomaly and sea surface temperature maps.



NOV 19-22/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

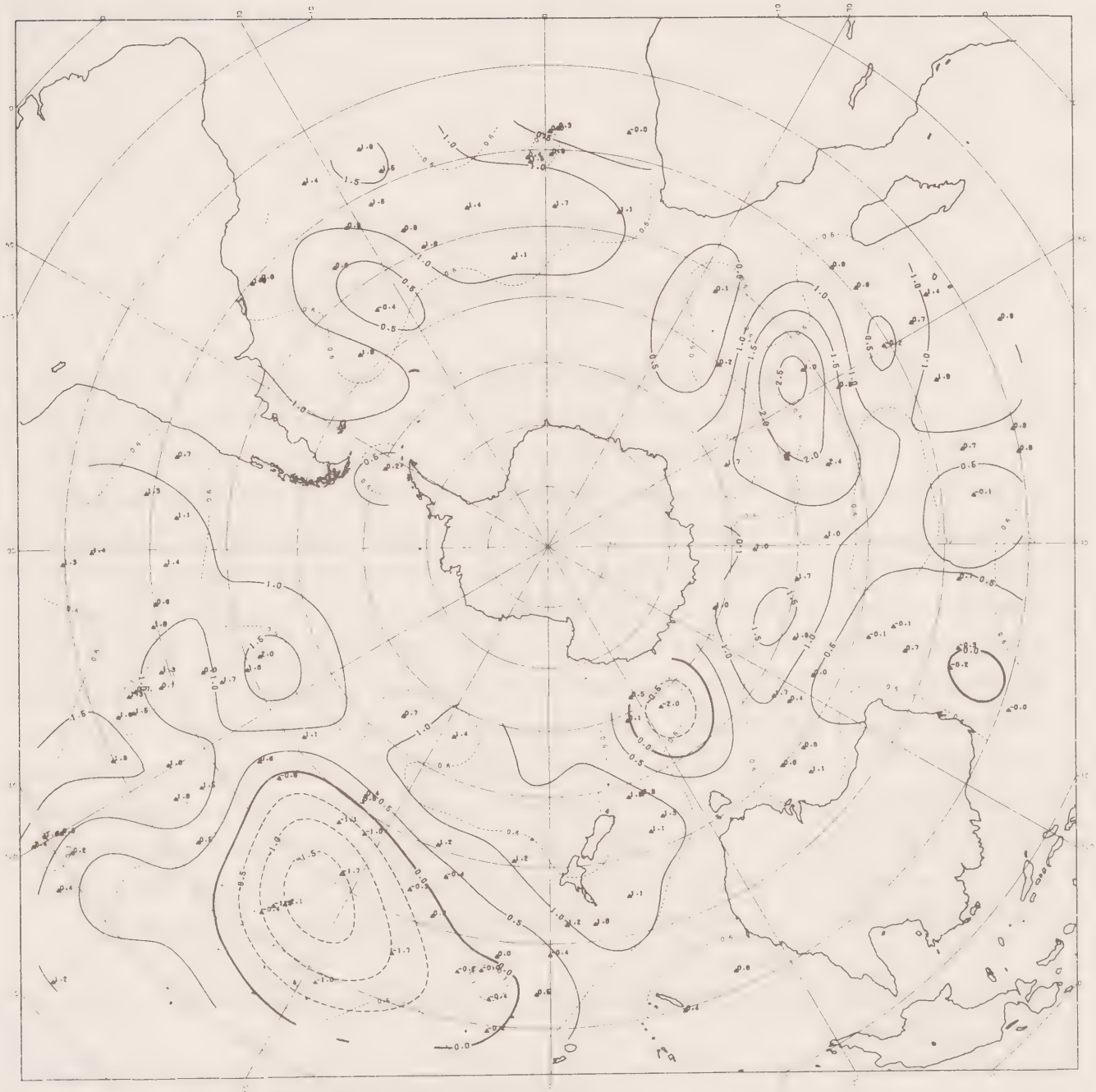
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: November 23 - 27, 1979

The number of reporting buoys is 129. The average sea surface temperature anomaly is 0.75°. The warm anomaly in the Indian Ocean (45°S, 60°E) no longer shows a double peak. The eastern peak has become absorbed in the western peak as buoy 17771 has moved eastward. The cold anomaly in the Pacific (30°S, 150°W) is colder than last time. The extreme is reported to be 2.1°. The warm anomaly east of this feature is cooler so that the sturcture of this feature is being lost.

NOTE: The comments on buoys 14662 and 14663 of last time apply this time as well.



NOV 23-27/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

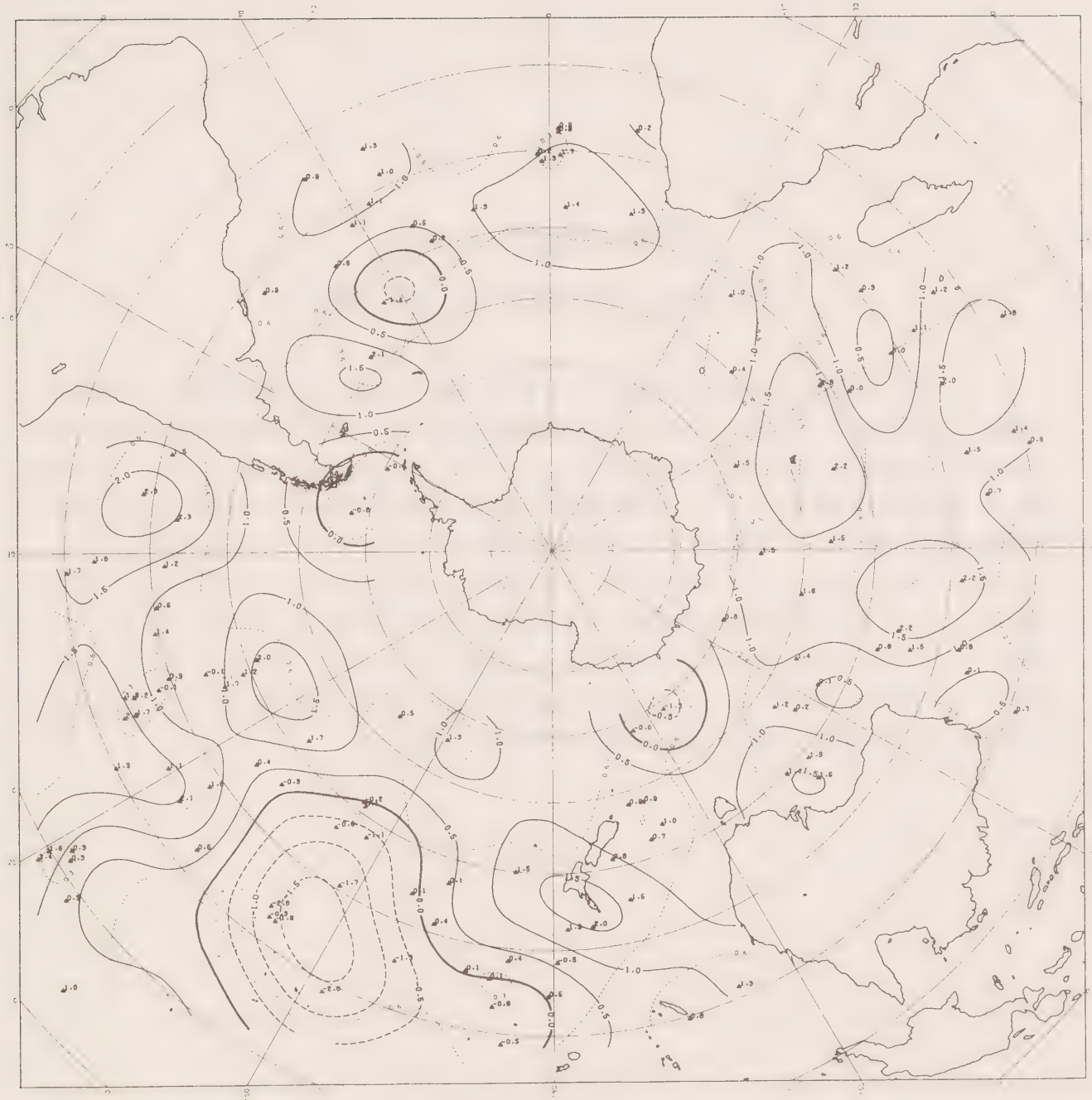
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: November 28 - December 2, 1979

The number of reporting buoys is 127. The average sea surface temperature anomaly is 0.84°C. Since last time, a cold feature has developed near Drake Passage (60°S, 75°W) with 2 buoys reporting cold anomalies. Last time, one of these, buoy 54620, did not report reliable temperatures. Another cold anomaly has developed around buoy 17649 at 45°S, 30°W. This buoy reports an anomaly 1.0° colder than before. The anomaly reported by this buoy has become steadily colder for at least the last 3 weeks. The warm anomaly which was centred on buoy 17771 is weaker and closer to buoy 17766 now (45°S, 75°E). The anomaly reported by buoy 17771 is 1.2° colder. Reported anomalies to the east of this feature are slightly warmer than before. A warm feature has developed centred on New Zealand (35°S, 175°E). Four buoys in the area (54656, 56618, 56616 and 17620) show an anomaly warmer by 0.4° on average. The large cold feature of the Pacific (25°S, 150°W) has extended to the north and west slightly. The extreme anomaly reported by buoy 56606 is now 0.5° colder than before. The large warm feature west of South America has broken into 3 features at 45°S, 120°W; 20°S,120°W; and 30°S, 80°W. Each one of these features has at least one buoy reporting anomalies of 2.0°C or larger.

NOTE: Comments made about buoys 14662 and 14663 in the November 18 - 22 report still apply.



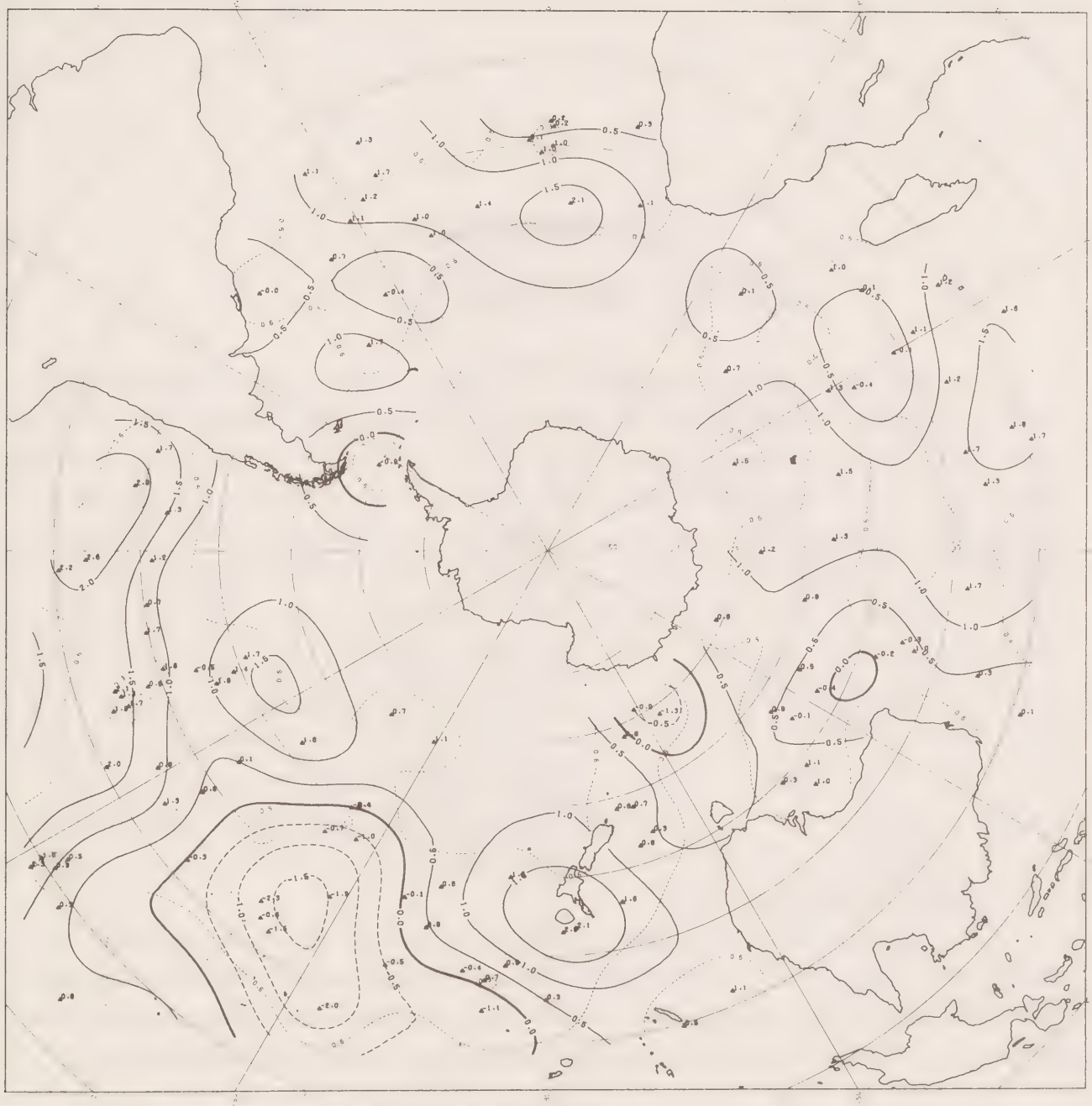
NOV 28 - DEC 2/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: December 3 - 7, 1979

The number of reporting buoys is 124. The average sea surface temperature anomaly is 0.80°C. The cold feature formerly centred on buoy 17649 (45°S, 30°W) has disappeared because this buoy reports an anomaly 1° warmer than last time. A warm feature has developed west of Africa centred on buoy 17658. The warm feature near New Zealand (35°S, 180°E) is slightly warmer than last time. The four buoys contained in the 1° contour all show warmer anomalies. The large cold anomaly in the Pacific (25°S, 150°W) is stable, although the extreme, reported by buoy 56606, is 0.3° warmer than last time. The northwestern part of the Pacific has been taken over by a broad warm feature centred at about 25°S, 90°W. An extreme to the south (45°S, 120°W) persists, although the buoys defining this feature report slightly cooler anomalies.



DEC 3-7/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

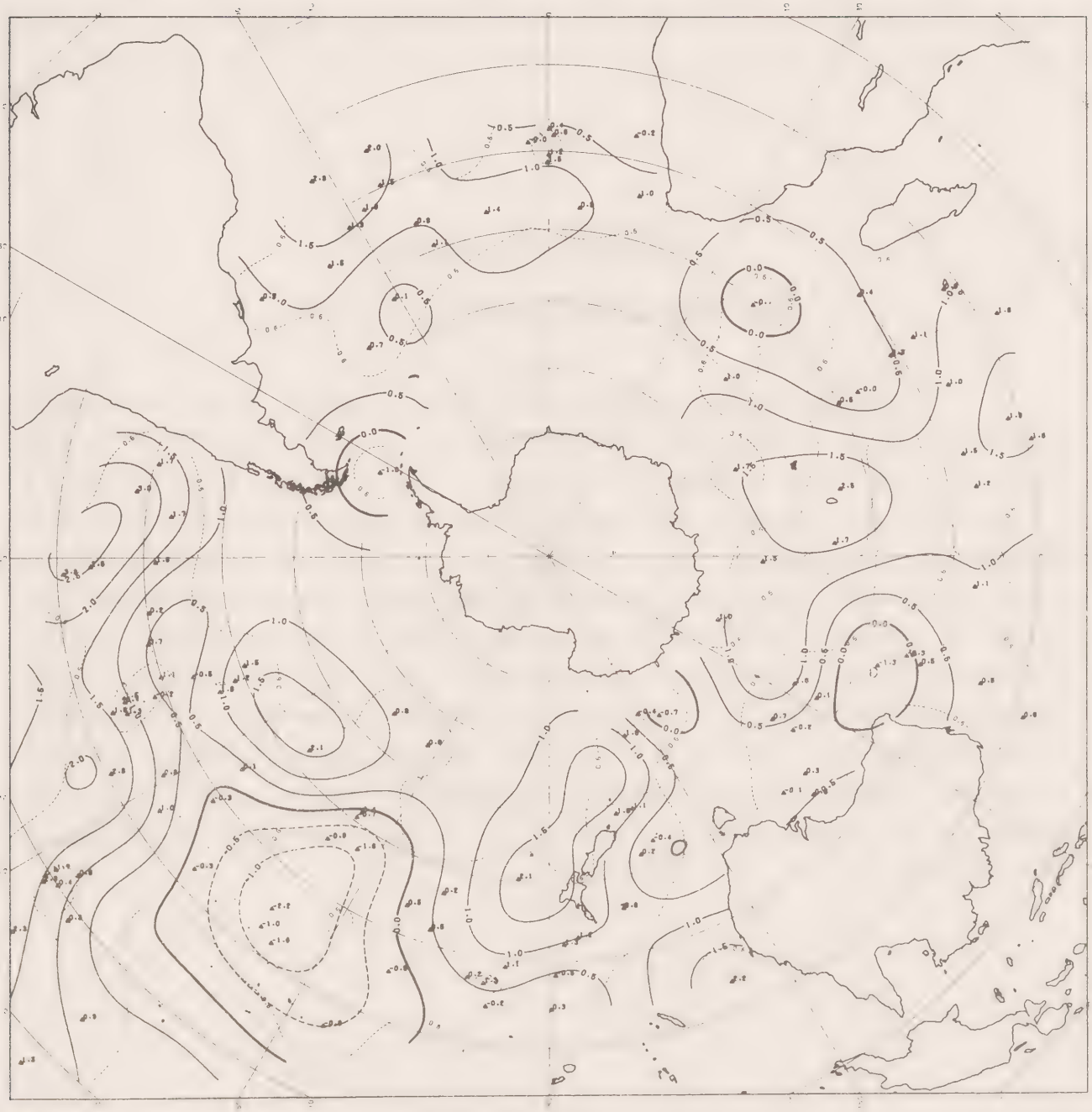
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: December 8 - 12, 1979

The number of reporting buoys is 122. The average sea surface temperature anomaly is 0.82°C. The warm anomaly which was centred on buoy 17658 (35°S, 5°E) is gone. This buoy now reports an anomaly of 0.9°, a 1.2° fall since last time. A cold anomaly has appeared centred on buoy 17608 at 40°S, 40°E. This is the only buoy in the area showing a cold anomaly, although in the last 15 days, the reported anomaly has fallen steadily. A warm anomaly has reappeared near 45°S, 80°E centred on buoy 17766. The anomaly reported is 1.0° warmer than last time; other buoys in the area show no corresponding change. The small cold feature off the southwest coast of Australia (40°S, 115°E) has expanded primarily because of the much colder anomaly reported by buoy 14641. The warm feature near New Zealand (40°S, 180°W) has shifted now to centre near buoy 54656. Buoys 56616 and 56618 on which this feature was centred last time report anomalies cooler by about 1° on average. Buoys south of New Zealand show a warmer anomaly than before. The other cold and warm features of the Pacific do not show any large changes from last time.

With the fall-off in reporting buoys, it is starting to become noticeable that reports from single buoys are generating cold or warm features in the anomaly maps. These features are less reliable than if more than one buoy were responsible for their generation. Readers are advised to exercise caution in acceptance of these features.



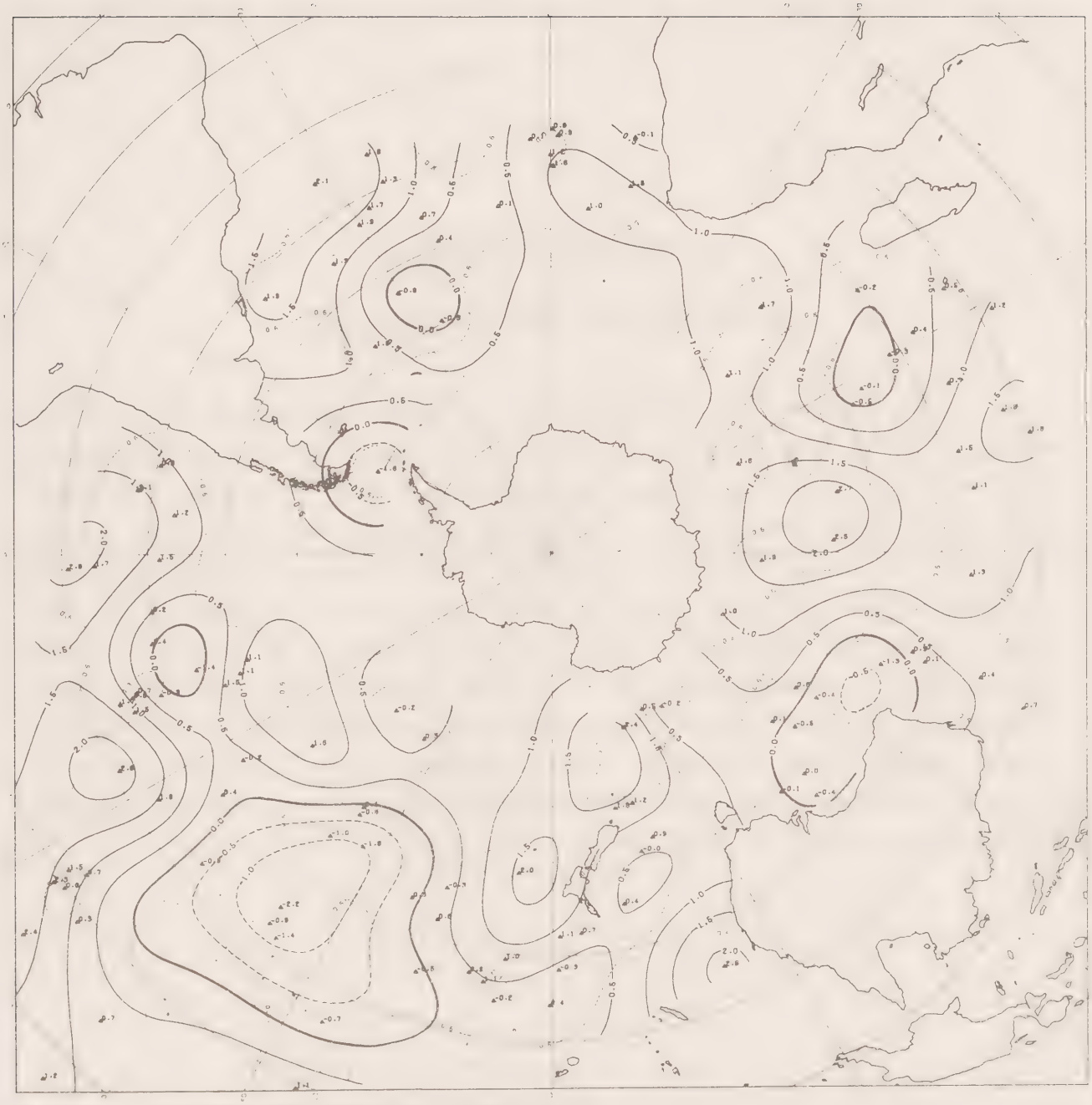
DEC 8-12/78 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: December 13 - 17, 1979

The number of reporting buoys is 122. The average sea surface temperature anomaly is 0.72°C. A cold feature has appeared east of Argentina (45°S, 30°W) with buoys 17649 and 54646 reporting cold anomalies. The latter buoy failed to report a reliable temperature last time. The warm feature to the north (25°S, 40°W) is stable with reported anomalies about the same as last time. The cold feature in the Indian Ocean has shifted to 35°S, 60°E with 4 buoys reporting cold anomalies. The warm feature formerly centred on buoy 17766 (45°S, 85°E) now encloses both this buoy and 16601. The cold feature off the southwest coast of Australia (40°S, 120°E) now is defined by 5 buoys reporting cold anomalies. A cold feature has appeared in the eastern Pacific (35°S, 105°W) because buoys 14623 and 54628 report cold anomalies. The latter buoy has consistently reported a cold anomaly for at least the last 15 days. The appearance of this feature has been encouraged by buoy 17646 failing to report, where last time it reported an anomaly of 1.1°.



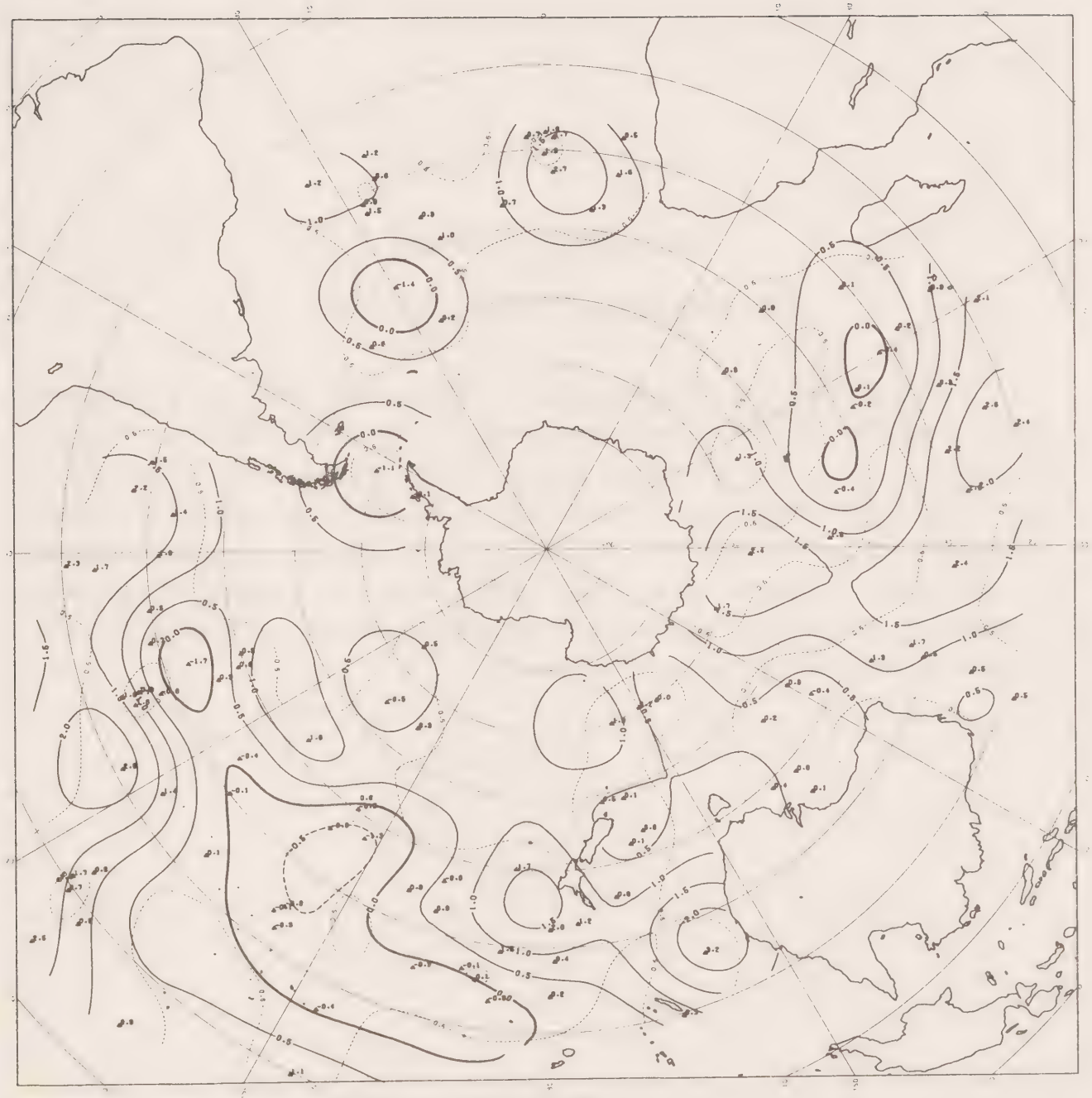
DEC 13-17/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: December 18 - 22, 1979

The number of reporting buoys is 118. The average sea surface temperature anomaly is 0.84°C. The warm feature formerly in the western Atlantic has disappeared, to be replaced by another warm feature centred on buoy 17661 (30°S, 0°E). The former feature has disappeared with buoy 74615 failing to report and a 0.9° cooler anomaly reported by buoy 74618. The latter feature shows all buoys in the area reporting warmer anomalies than last time, with buoy 17661 reporting an anomaly 1.1° warmer. The cold feature southwest of Madagascar (35°S, 70°E) has extended to the southeast with the dramatic change in the anomalies reported by buoys 17766 and 16601. On average, these buoys show a drop of 1.8° in their reported anomalies. The cold feature south of Australia is gone with buoy 14641 reporting an anomaly warmer by 2.6°. The cold feature in the Pacific is considerably weaker, the extreme anomaly being -1.3° reported by buoy 54627. This is 0.9° warmer than the last extreme.



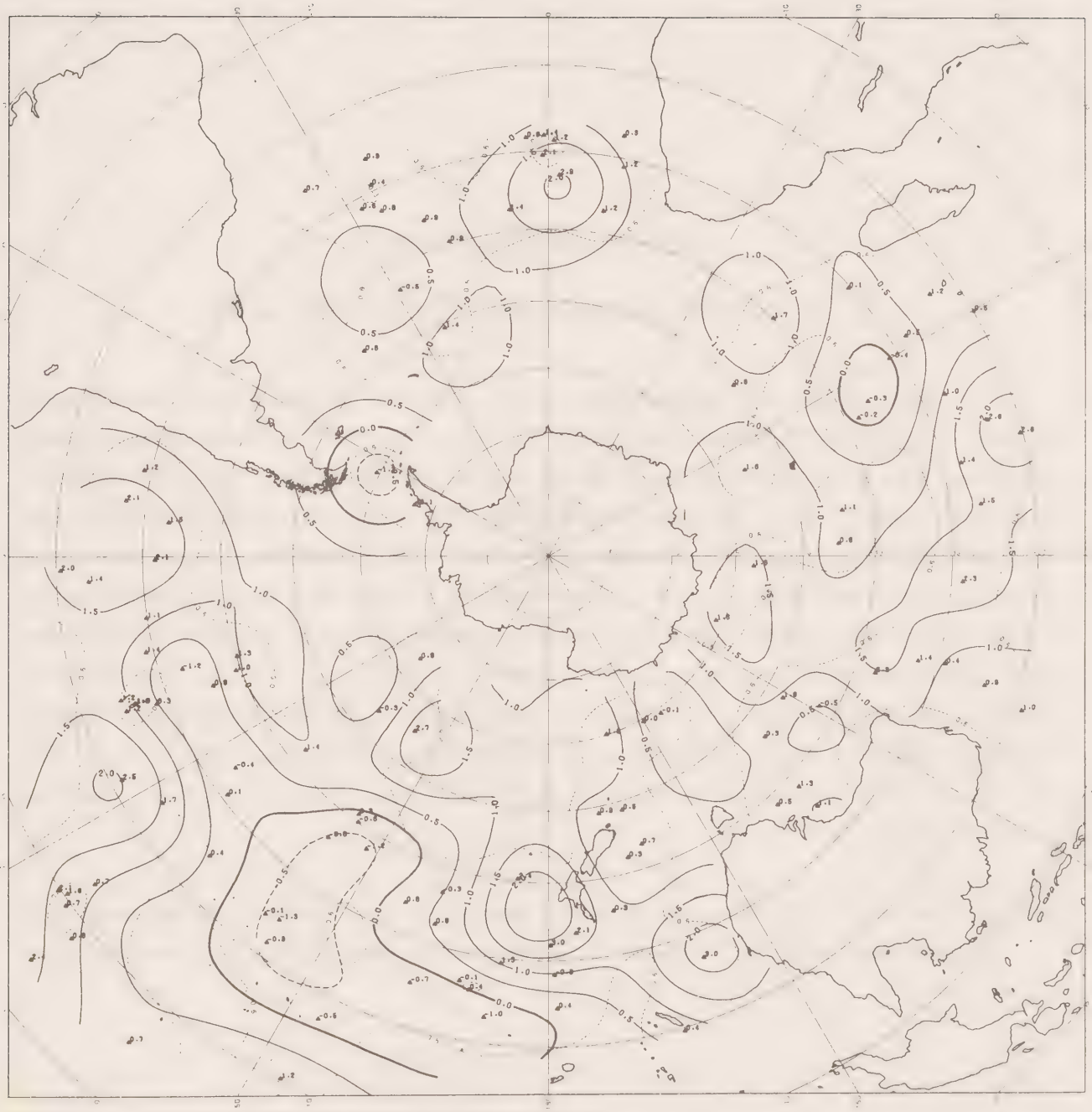
DEC 18-22/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: December 23 - 27, 1979

The number of buoys reporting is 119. The average sea surface temperature anomaly is 0.89°C. The cold feature centred on buoy 17649 (40°S, 30°W) is gone with this buoy reporting an anomaly 0.9° warmer than last time. The cold feature in the Indian Ocean (35°S, 60°E) is smaller again because buoy 17765 reports an anomaly 1.5° warmer than before. The warm feature near New Zealand (35°S, 180°E) is stronger than before with buoy 56618 reporting an anomaly 1.0° warmer. Buoy 56616 reports an equivalent rise, and buoy 54656 to the southeast also reports an anomaly warmer than 2°. The remaining features show no substantial changes.



DEC 23-27/79 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

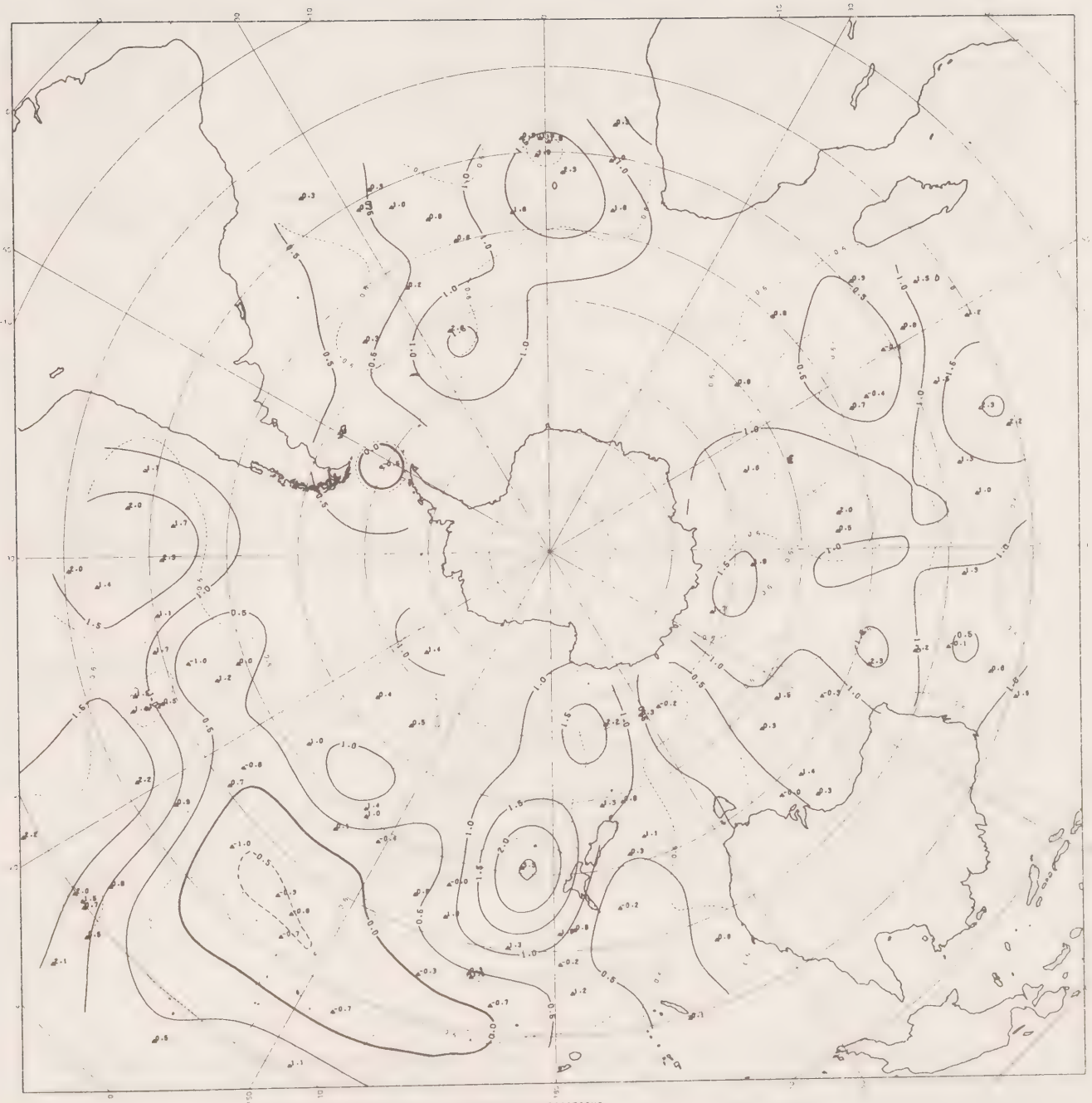
INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

FGGE Drifting Buoy Product

SST Anomaly Map: December 28. 1979 to January 1, 1980

The number of reporting buoys is 117. The average sea surface temperature anomaly is 0.92°C. The warm feature west of Africa (35°S, 0°E) shows slightly cooler anomalies. The largest change is 0.6° and is reported by buoy 17661. The cold feature in the Indian Ocean (35°S, 60°E) is gone with now only 2 buoys reporting cold anomalies. The warm feature off Australia and centred on buoy 56633 (25°S, 140°E) is gone with this buoy reporting an anomaly cooler by 2.2°. The warm feature near New Zealand has shifted to centre on buoy 54656 (40°S, 175°W). This buoy reports an anomaly 1.1° warmer and is the only buoy reporting an anomaly warmer than 1.6°. The cold feature in the Pacific (25°S, 150°W) again shows warmer anomalies, with the extreme being 0.3° warmer than before. There are now only 7 buoys in the area reporting cold anomalies, where before there were 10. The warm features of the low latitude Pacific show cooler anomalies in the west but no change in the east.

NOTE: This map is the same day span, one year later from the first SST anomaly map produced by MEDS. The only similar feature is, perhaps, the cold anomaly in the Pacific.



DEC 28/79 - JAN 1/80 CONTOURS BASED ON ANOMALY TEMPERATURE (DEG C) AT AVERAGE BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

OTHER PRODUCTS

There were three other products besides the contour maps mentioned in the previous section. Two of these were track charts of the buoy position over the 5-day periods, and track charts tracing the buoy position over a month. The 5-day charts were annotated by buoy numbers, SST and SST anomaly, and are presented in Figures 173-246 (*on microfiche*). The monthly track charts were annotated by the buoy number and the start and end dates of the record for the month. These charts constitute Figures 247-258 (*on microfiche also*).

For each 5-day period, a note was produced which summarized the changes in the SST anomaly chart from the last period. These notes are included beside Figures 25-98.

A SUMMARY OF THE YEAR OF FGGE DATA

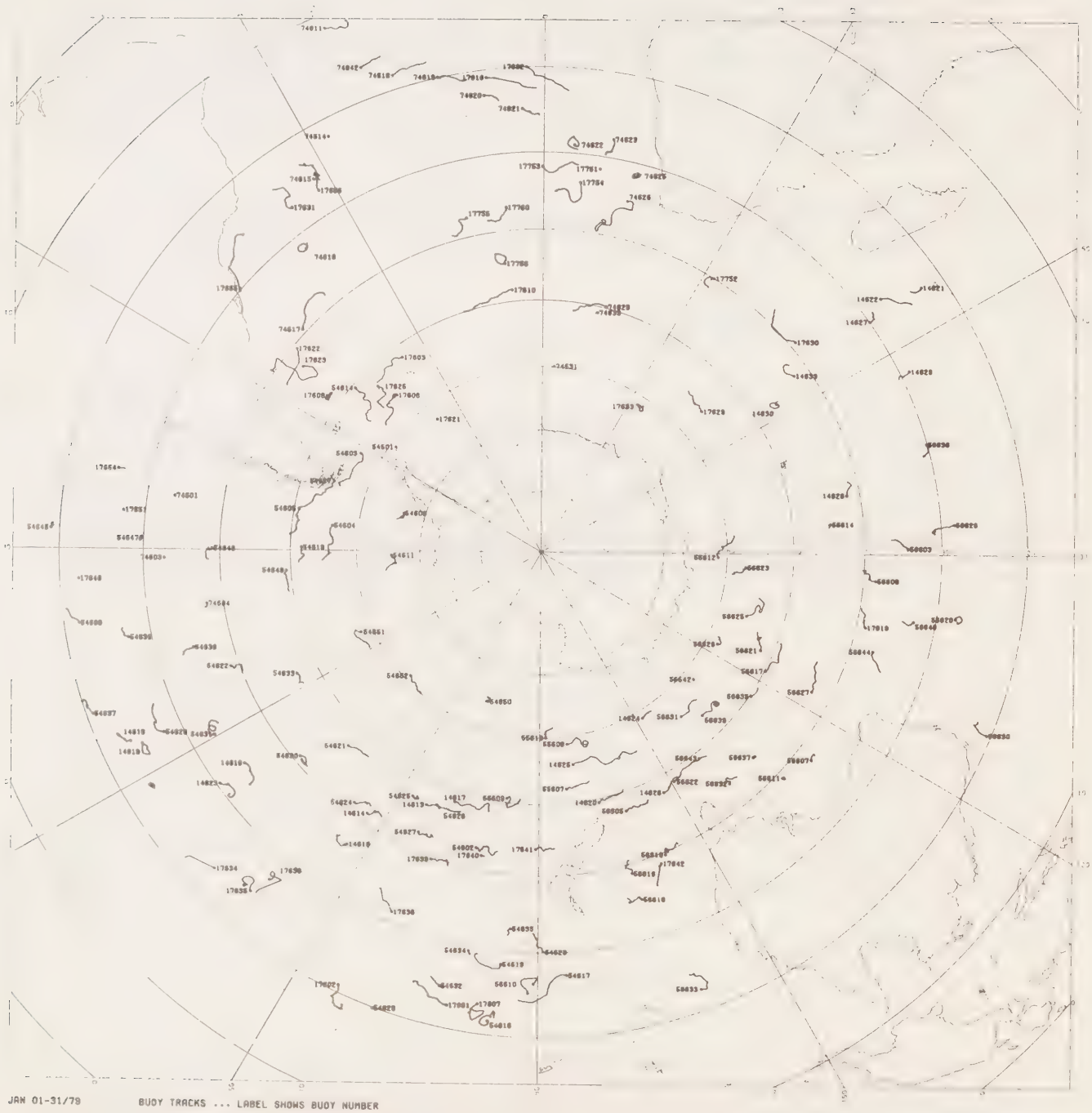
After completing an entire year of analyses for the FGGE buoy, it was thought that some simple presentations of certain aspects of the data would be helpful (Figure 259). The dotted lines in the figure are the mean values, and the lighter lines are 95% confidence intervals. The central curve shows the interesting fact that the mean SST anomaly was positive and significantly different from zero for the entire year. This implies that either the southern ocean was warmer than climatology would suggest or the climatology was biased toward low temperatures.

The set of curves (Figure 260) shows the covariance of the 5-day SST anomalies averaged by month. Again, light lines are 95% confidence intervals. The circle at zero distance is the average variance in each month. It appears that the covariance falls off slightly faster in the winter months of the southern hemisphere, although the distance to the first zero crossing does not appear to vary significantly. It also seems that the covariance is negative at 3,000 to 4,000 km in the summer months, while in the winter it is not significantly different from zero. Since the covariance function was generated without regard to directional relationships, this observation is based on a calculation which has smeared out any meridional or zonal dependence which may be present.

ACKNOWLEDGEMENTS

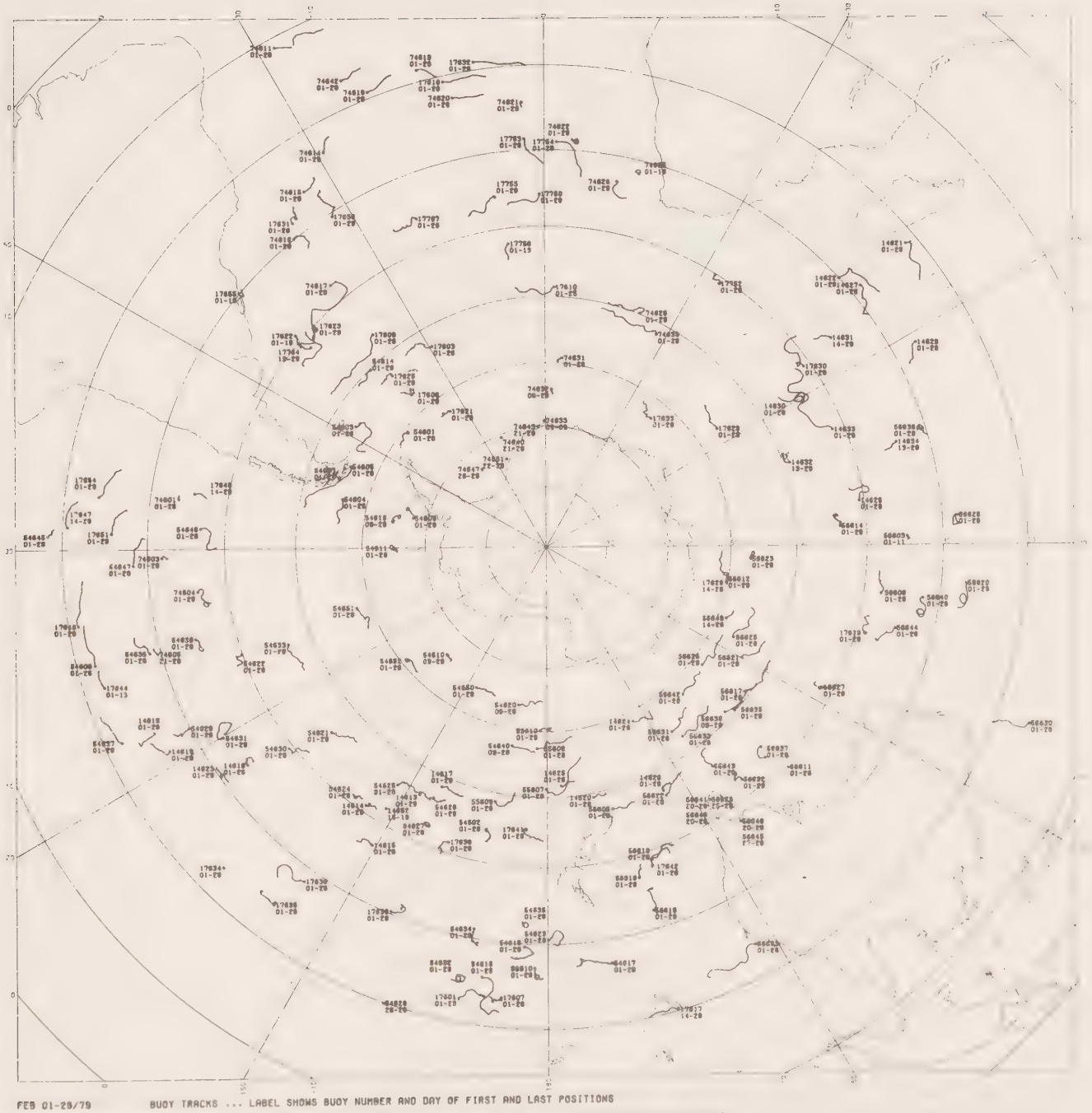
The authors would like to express their appreciation to all of the staff at the Marine Environmental Data Service who participated in the preparation of the products presented in this report. It was only through their diligent and enthusiastic support that it was accomplished. Drs. H. J. Freeland, N. Boston and J. Garrett provided helpful comments in the preparation of the report.

Figs. 247-258. Buoy drift tracks over each month. Numbers beside each buoy are identification numbers and the start and end day for which they reported positions in that month.



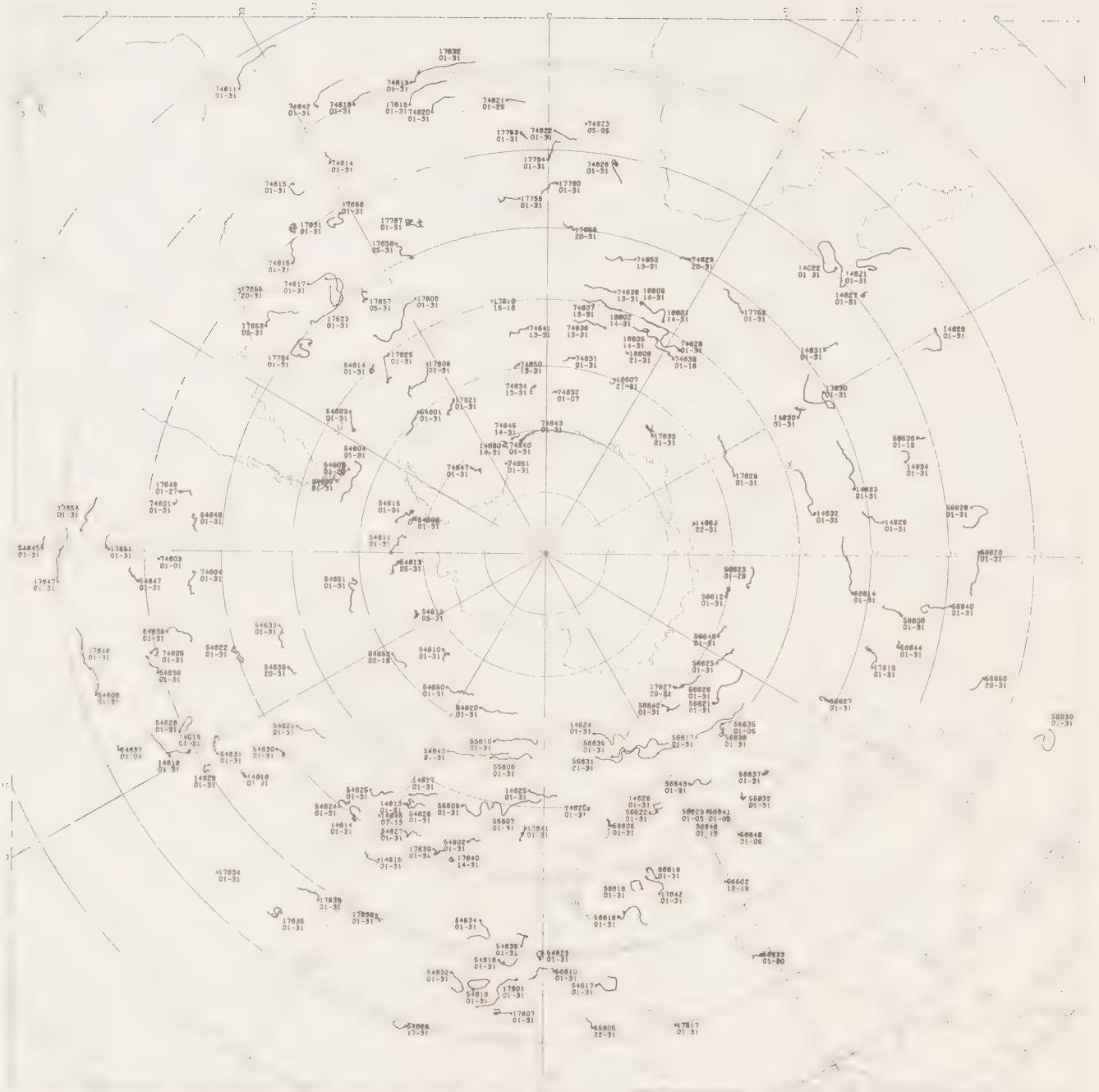
JAN 01-31/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



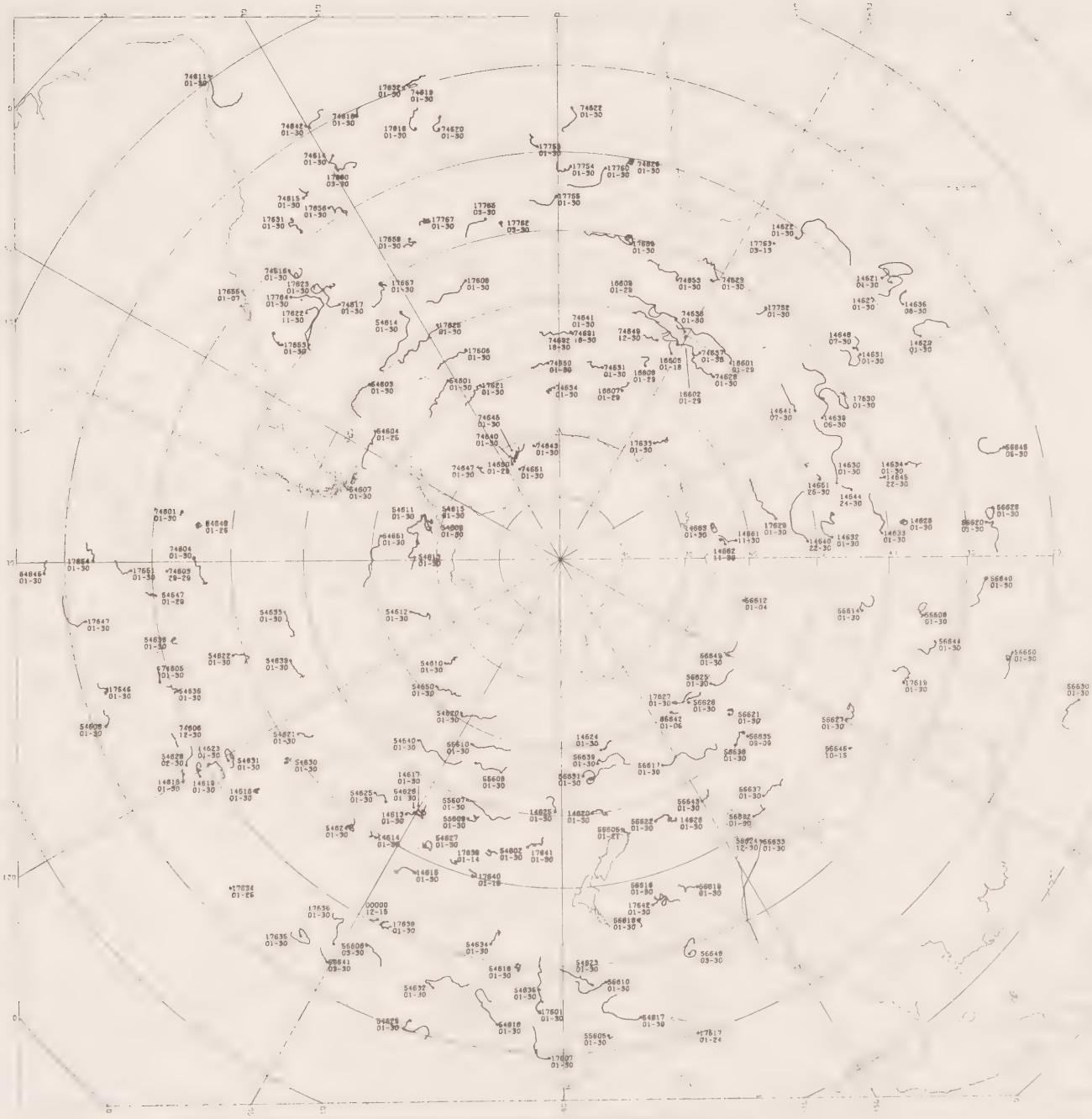
FEB 01-28/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



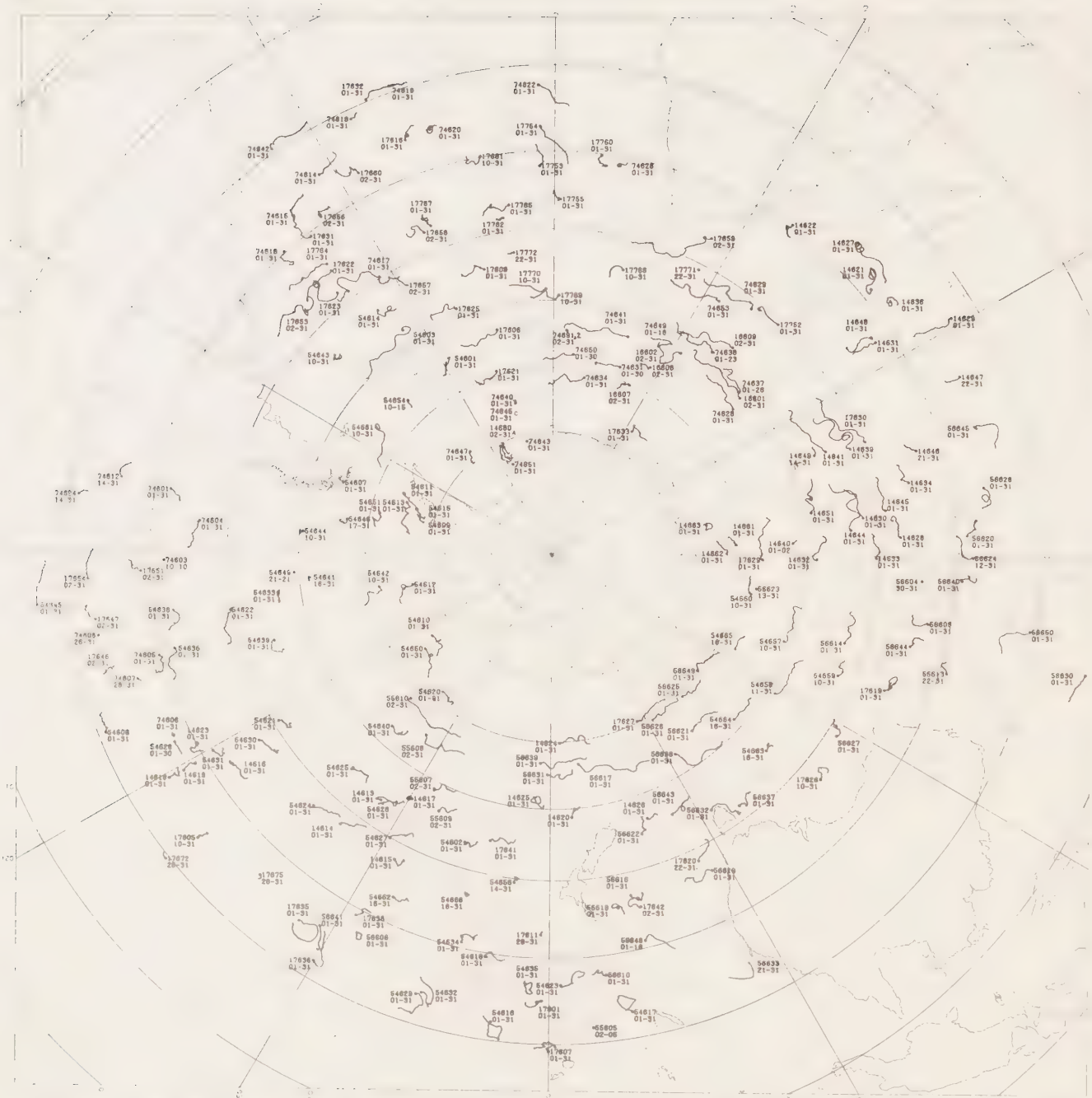
MARCH 01 - 31/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



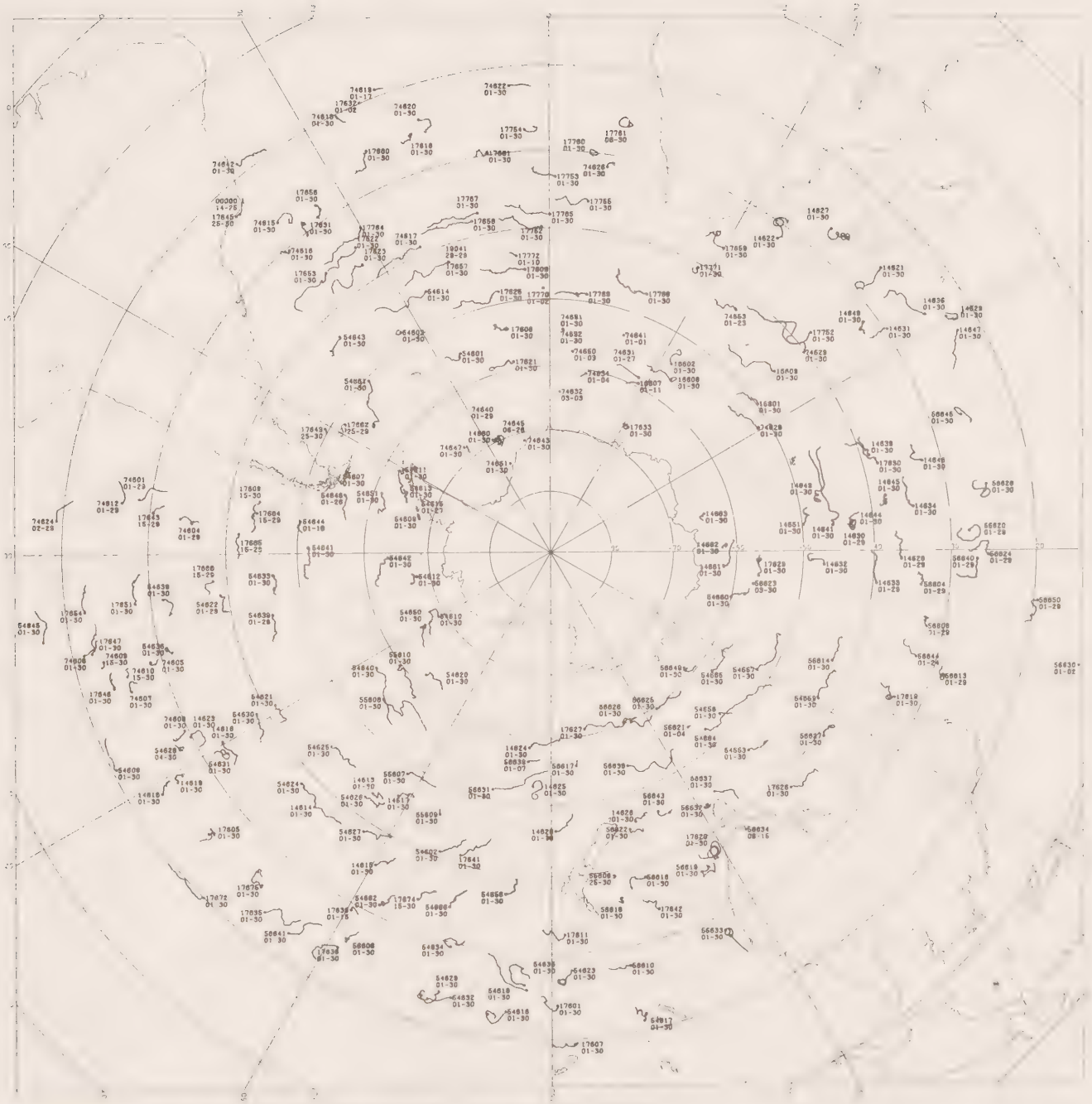
APRIL 01 - 30/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



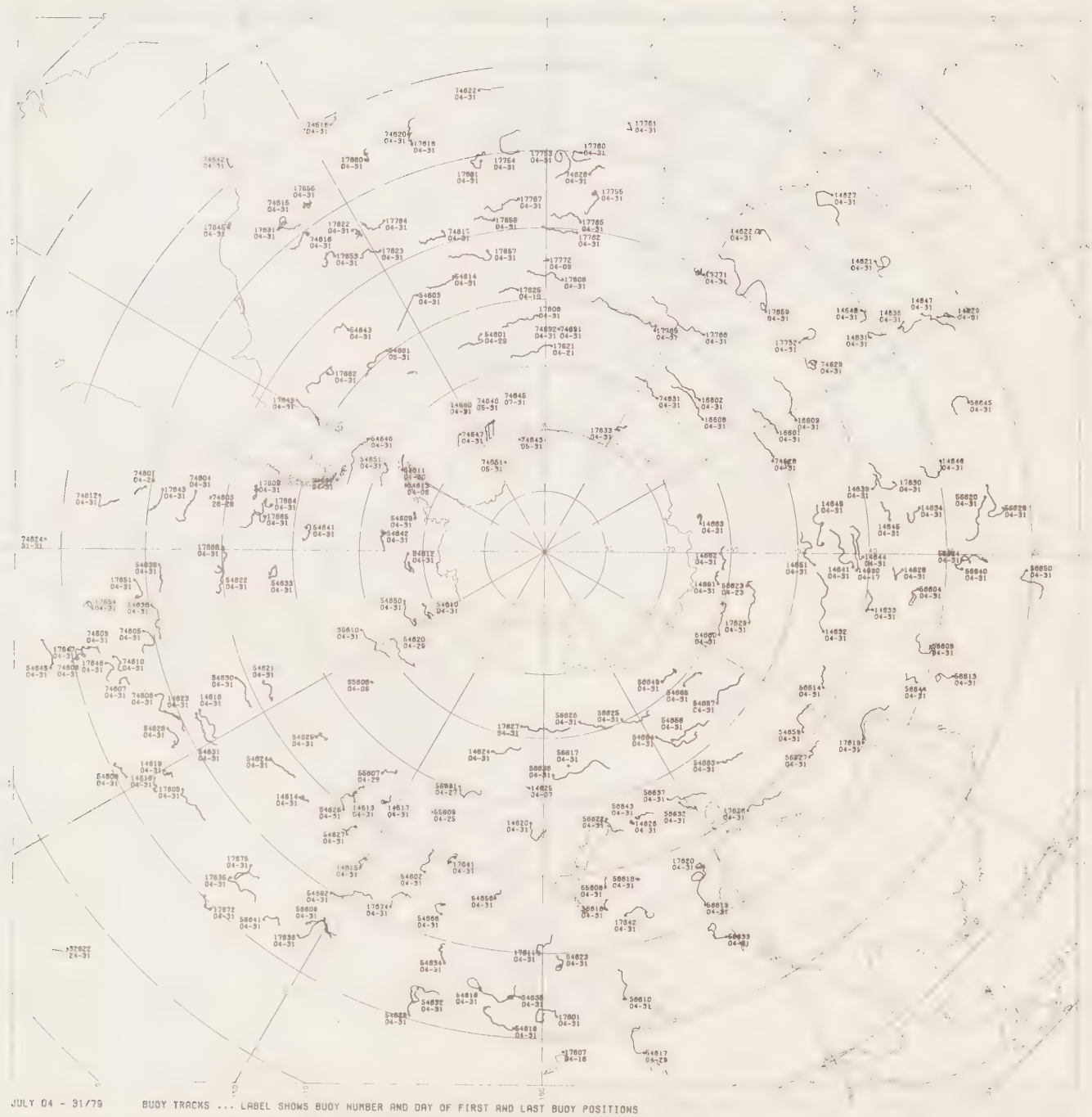
MAY 01 - 31/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



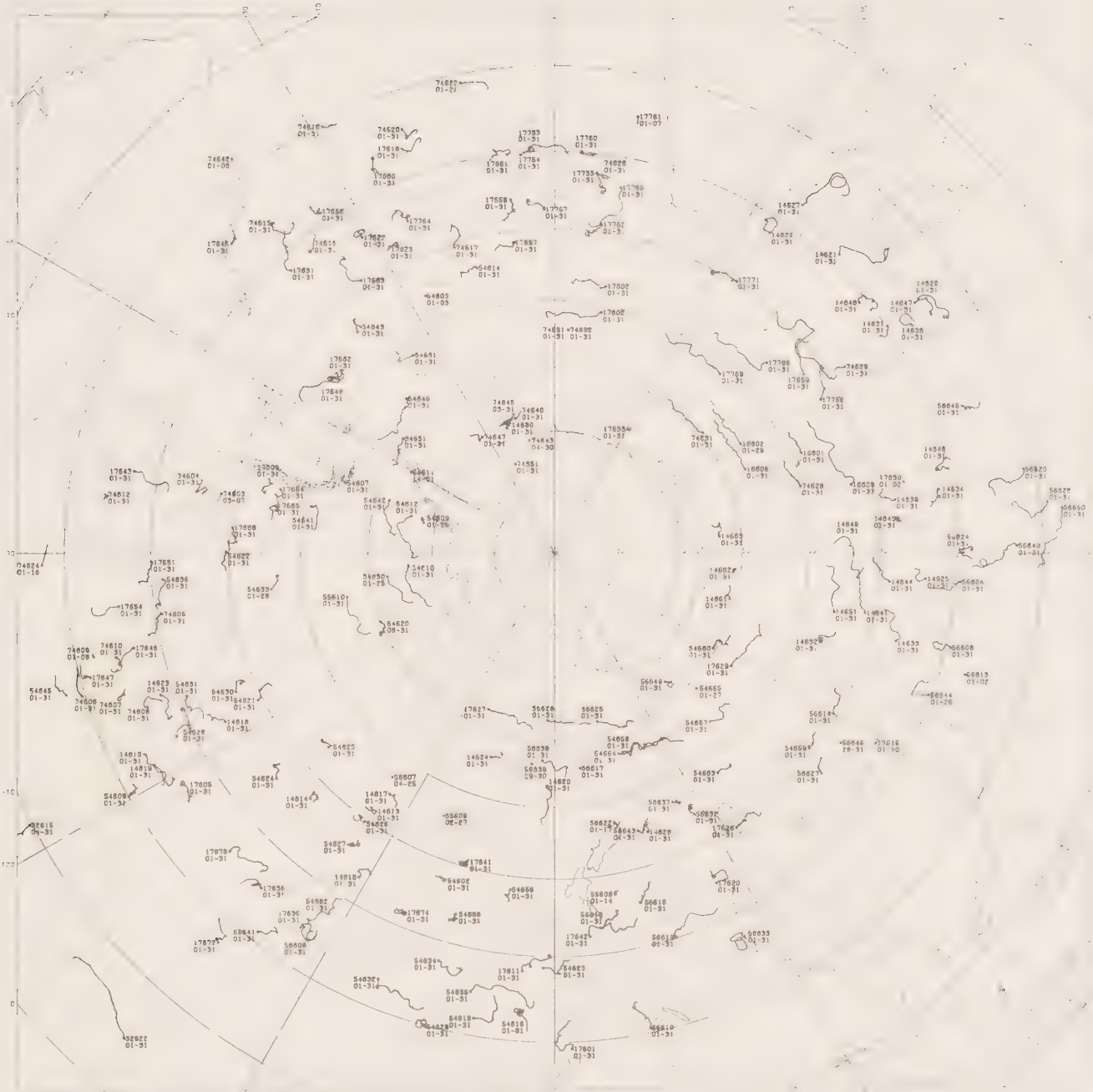
JUNE 01 - 30/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



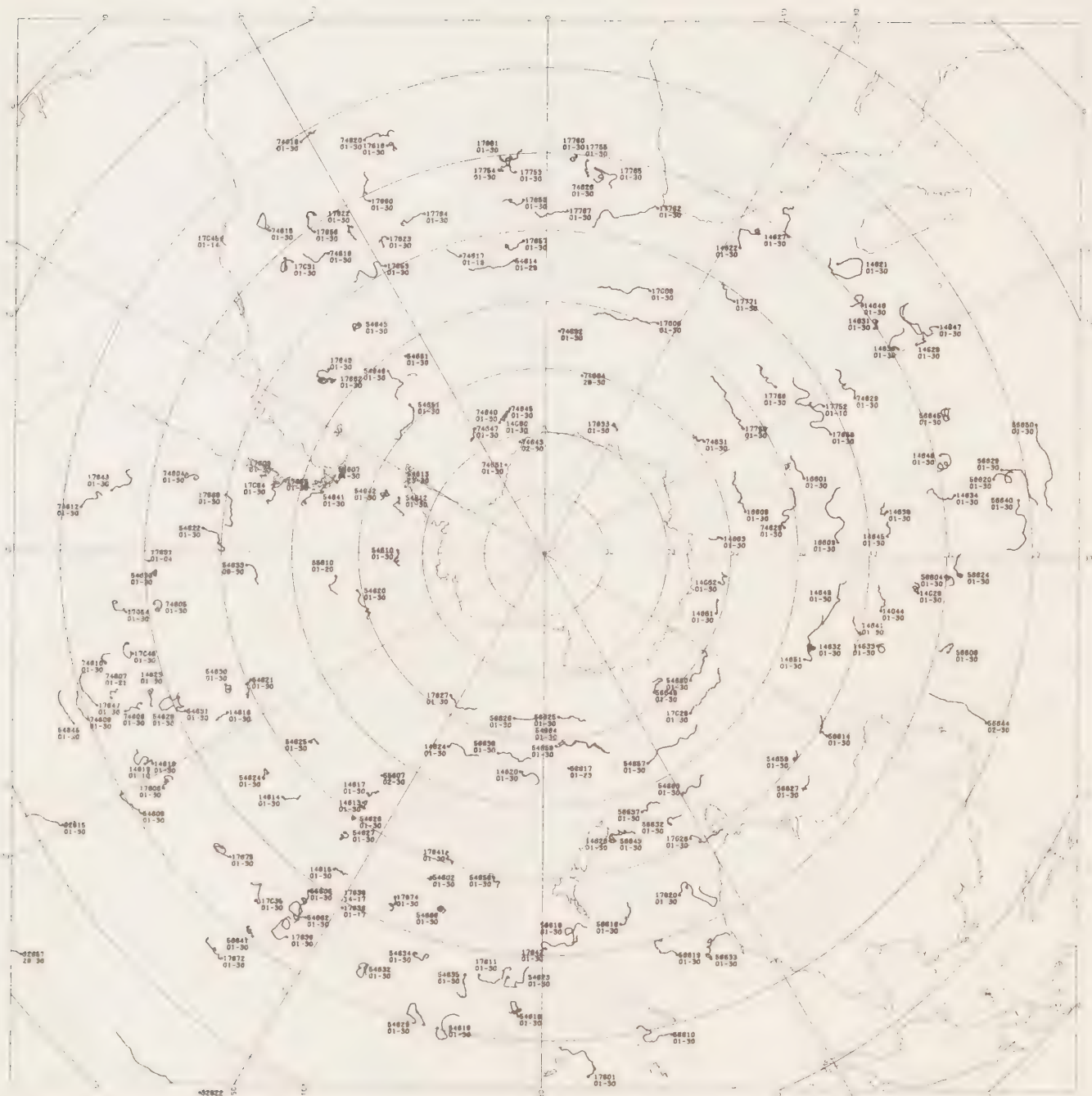
JULY 04 - 31/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



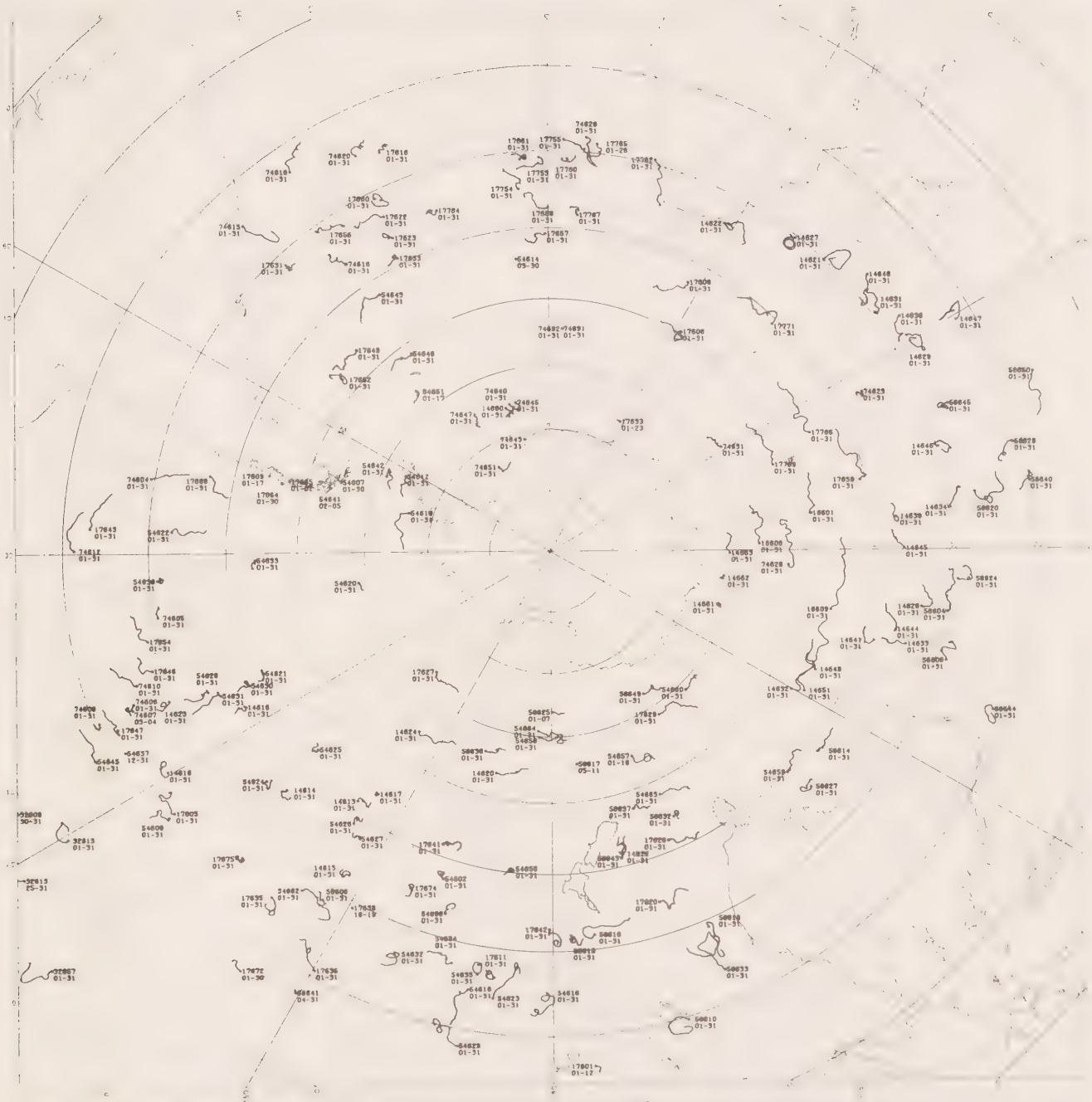
AUGUST 01 - 31/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA



SEPTEMBER 01 - 30/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

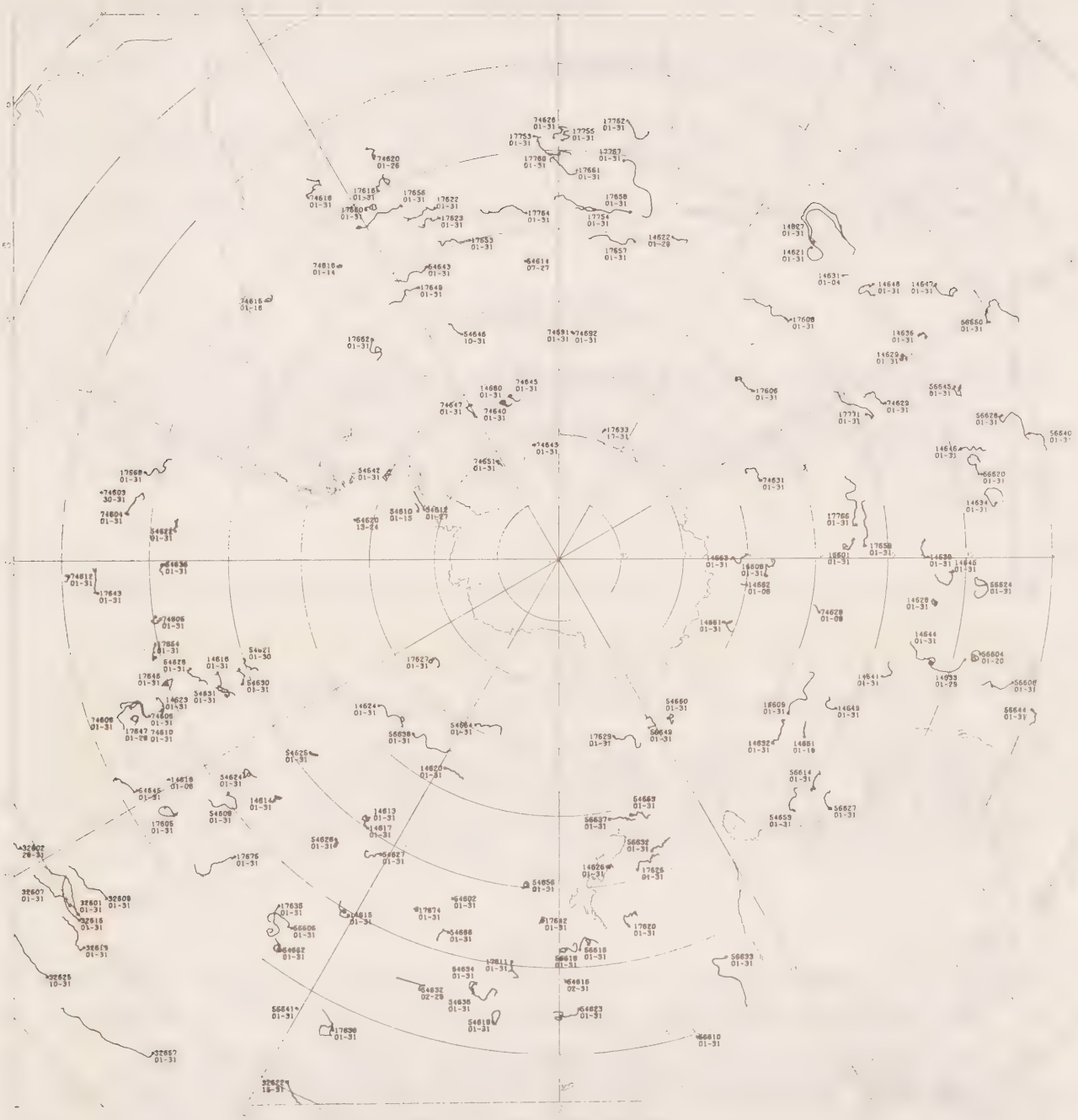


OCTOBER 01 - 31/79 BUOY TRACKS --- LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

NOVEMBER 01 - 30/79 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) . BY THE MARINE ENVIRONMENTAL DATA SERVICE.



DECEMBER 01 - 31/78 BUOY TRACKS ... LABEL SHOWS BUOY NUMBER AND DAY OF FIRST AND LAST BUOY POSITIONS

INTEGRATED GLOBAL OCEAN STATION SYSTEM (IGOSS) PRODUCT IN SUPPORT OF THE FIRST GARP GLOBAL EXPERIMENT (FGGE) , BY THE MARINE ENVIRONMENTAL DATA SERVICE, CANADA

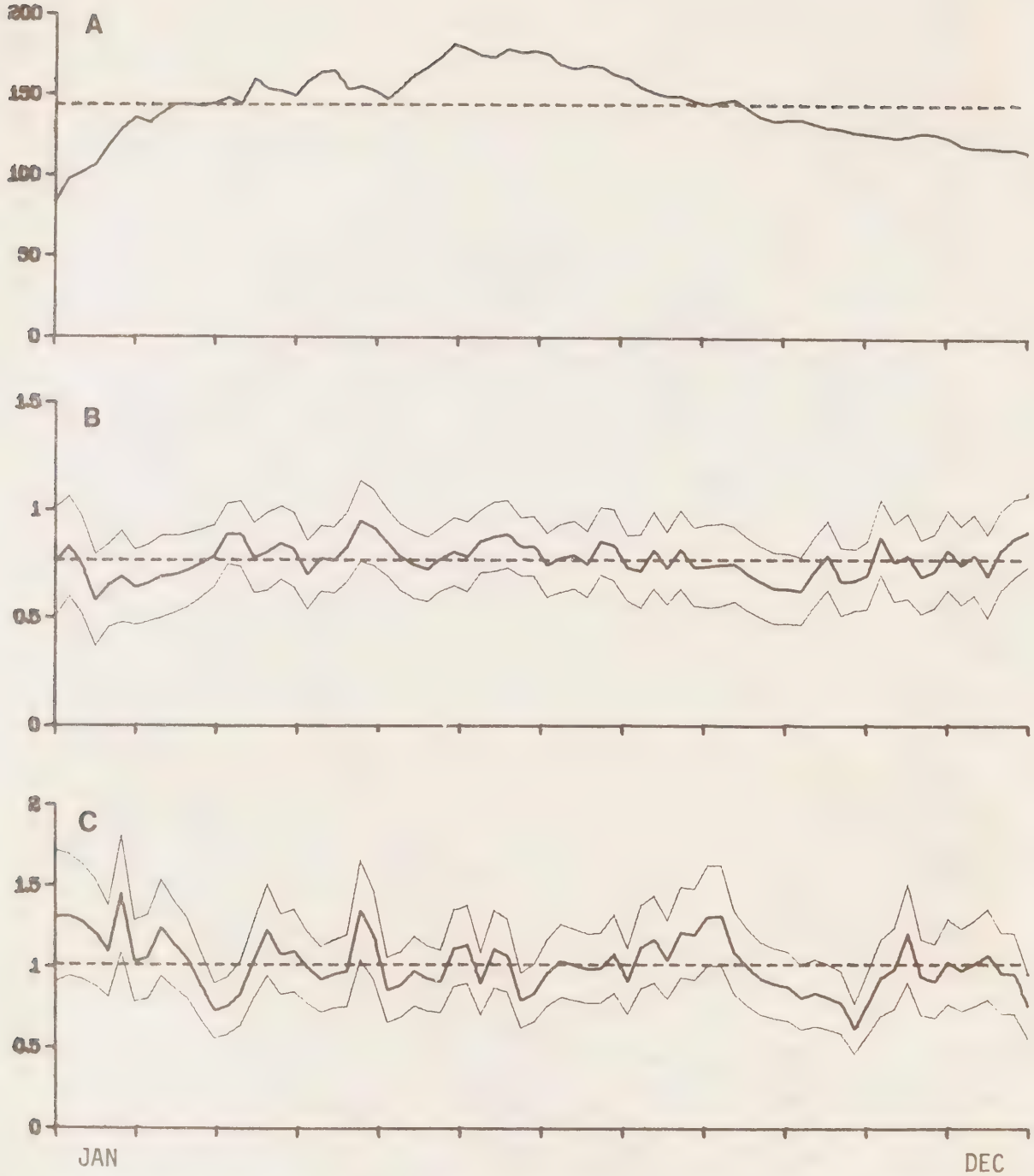


Fig. 259. Statistics on the FGGE 5-day averages of SST anomalies during 1979: a) shows the number of buoys used in calculating anomalies; b) shows the average anomaly in C°; c) shows the variance of the anomaly in $(C°)^2$. In all cases the dashed line shows the mean and the lighter line the 95% confidence interval.

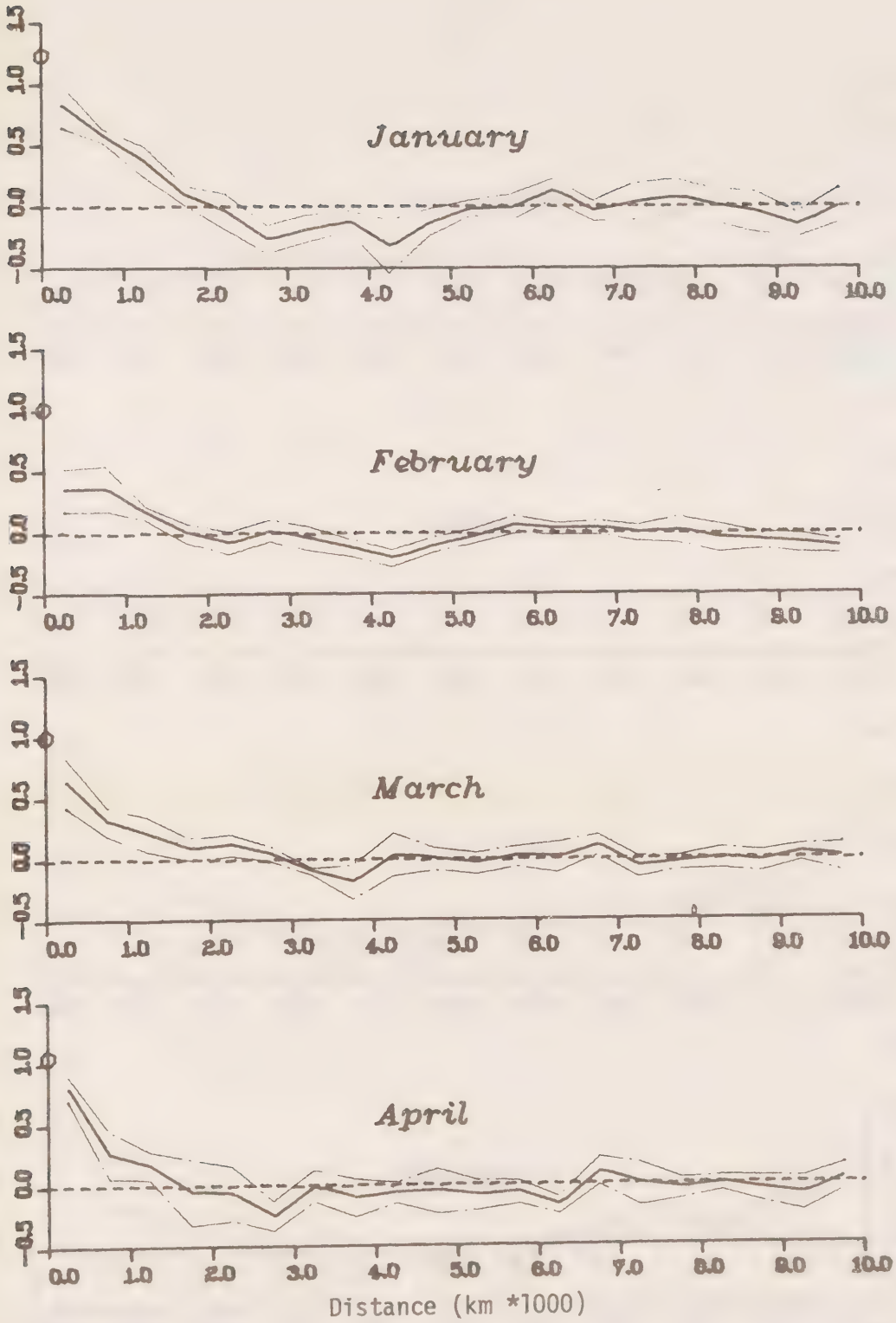
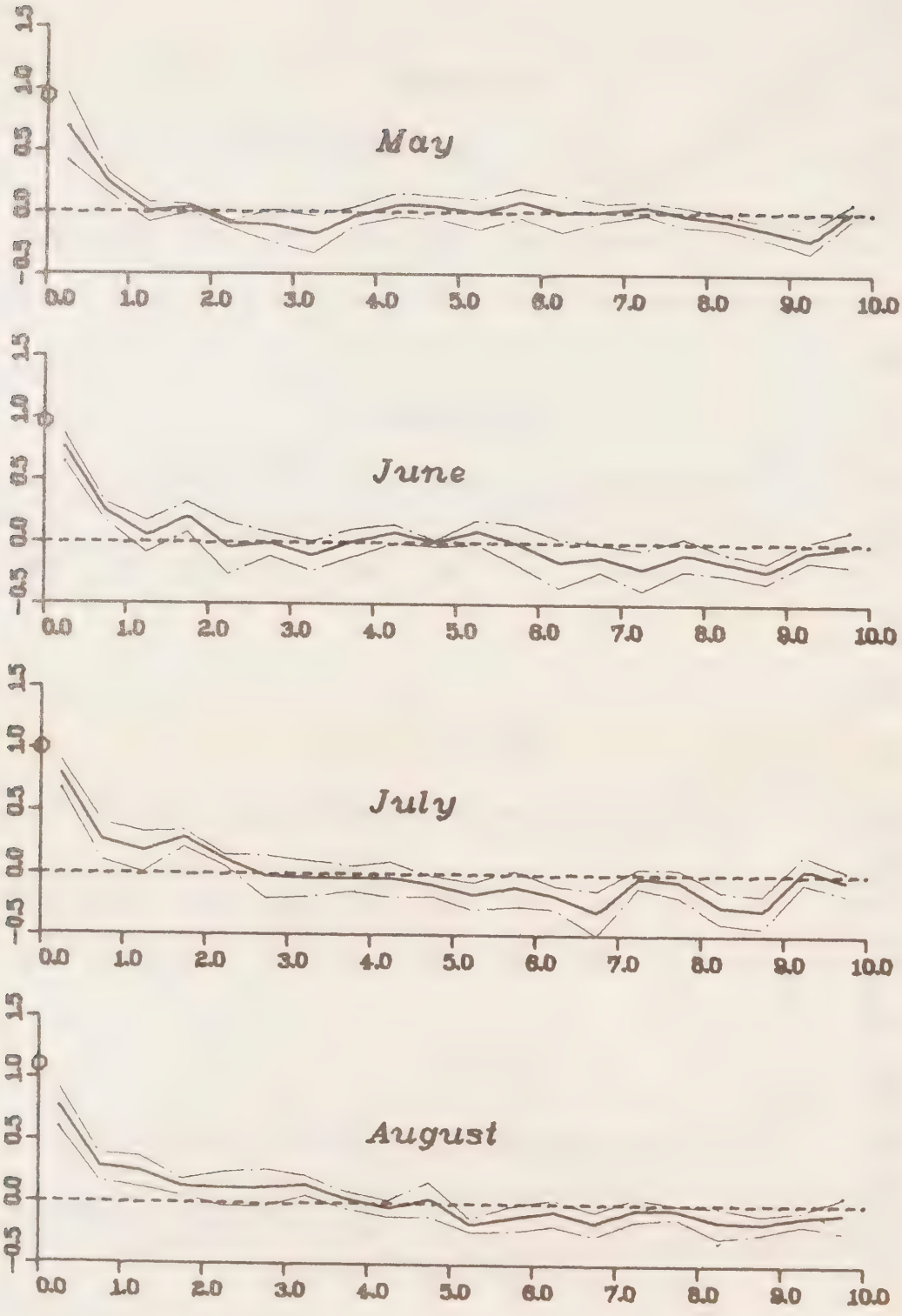


Fig. 260. Covariance versus distance by month for SST anomalies.


May
June
July
August
1.5
1.0
0.5
0.0
-0.5
0.0
1.0
2.0
3.0
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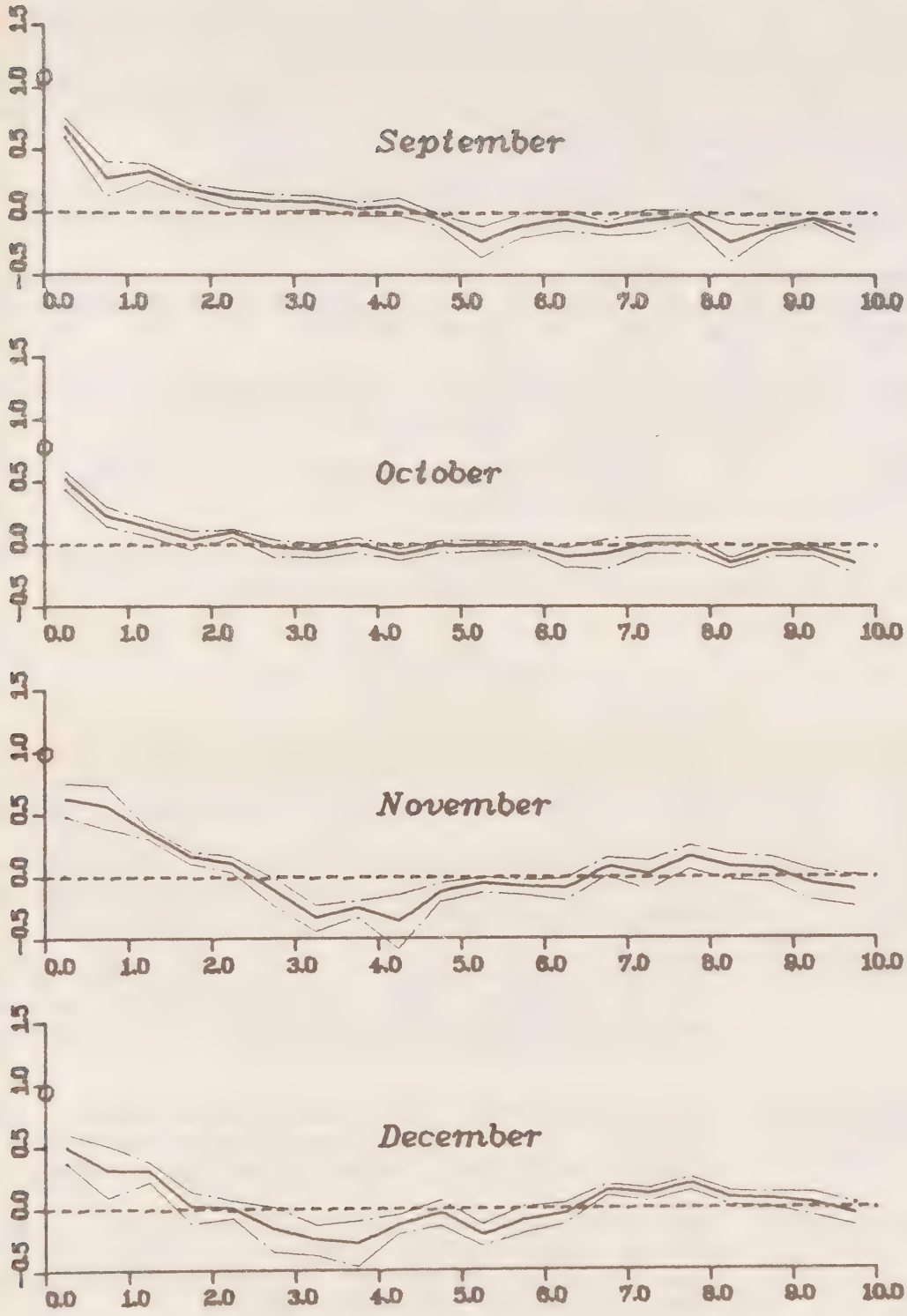
5.0
6.0
7.0
8.0
9.0
10.0


September
October
November
December
1.5
1.0
0.5
0.0
-0.5
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

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LIST OF FIGURES

Figures 247-258. Buoy drift tracks over each month. Numbers beside each buoy are identification numbers and the start and end day for which they reported positions in that month (*on microfiche and in the text*).

Figure 259. Statistics on the FGGE 5-day averages of SST anomalies during 1979: a) shows the number of buoys used in calculating anomalies; b) shows the average anomaly in C°; c) shows the variance of the anomaly in $(C°)^2$. In all cases the dashed line shows the mean and the lighter line the 95% confidence interval.

Figure 260. Covariance versus distance by month for SST anomalies.